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North Central Forest Experiment Station

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A Second Look at North Dakota's Timber Land

Pamela J. Jakes and W. Brad Smith

This report includes the most commonly used Resources Evaluation statistics, but other forest resource data can also be provided. Persons requesting additional information from the raw inventory data are expected to pay the retrieval costs. These costs will vary depending on the complexity of the request, from less than $100.00 for a simple request to $2,000.00 for a complex retrieval involving the services of a Resources Evaluation computer programmer. Requests for data will be scheduled to minimize the impact on the Resources Evaluation work unit.

Requests for unpublished information may be directed to:

Burton L. Essex
Renewable Resources Evaluation Project
North Central Forest Experiment Station
1992 Folwell Avenue
St. Paul, Minnesota 55108

Phone: (612) 642-5282

Area served: Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, eastern South Dakota, Wisconsin

North Central Forest Experiment Station
Forest Service—U.S. Department of Agriculture
1992 Folwell Avenue
St. Paul, Minnesota 55108
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FOREWORD

Resources Evaluation is a continuing endeavor as mandated by the Forest and Rangeland Renewable Resources Planning Act of 1974 (RPA). Its objective is to periodically inventory the Nation's forest land to determine the extent, condition, and volume of timber, growth, and depletions. This kind of up-to-date information is essential for intelligent forest policies and programs. USDA Forest Service regional experiment stations are responsible for conducting these inventories and publishing summary reports for individual States. The North Central Forest Experiment Station is responsible for Resources Evaluation work in Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, eastern South Dakota, and Wisconsin.

The second North Dakota Forest Inventory was directed by Burton Essex, Resources Evaluation Project Leader. Mark Hansen, Gerhard Raile, and Brad Smith of the Project's Techniques Group, and Project Leader Essex were responsible for inventory design and sample selection. Data processing and generation of summary tables were handled by the Techniques Group. Arnold J. Ostrom supervised the aerial-photo and data collection, with support from Dale Krueger and Tom Castonguay in the St. Paul office and Roger Jensen in the field. Aerial photos were supplied by the USDA Agricultural Stabilization and Conservation Service. James Blyth designed and supervised collection of timber product output and timber removals data, with assistance from Walter Pasicznyk, Deputy State Forester, North Dakota Forest Service. Pamela Jakes checked consistency of the second North Dakota Forest Inventory with the first and ran the 30-year projections of timber volume. Brad Smith evaluated treatment opportunities in the State.

Many State and Federal employees provided background information for the analysis of North Dakota's second Forest Inventory, including Samuel Becker, State and Private Forestry, USDA Forest Service; Robert Morgan, North Dakota Game and Fish Department; Glenn Roloff, USDA Forest Service; and John Van Ells, North Dakota Forest Service. Mary Jean Hanson, Patrick Peine, and Jean Smoley helped prepare the State tables and manuscript.

Aerial photo interpretation began in June 1978 and was completed in July 1979. The Bureau of Indian Affairs conducted preliminary field checks in 1978. Between June and November 1979, crews from the North Central Station conducted their fieldwork. The report on the previous survey was dated 1954. Computer updates were made for RPA for the years 1962, 1970, and 1977.

HIGHLIGHTS

Area

- One percent of North Dakota's land area is forest land.
- There are 985,700 acres of nonforest land with trees in the State, nearly half in improved pasture.
- The 343,200 acres of commercial forest land reported in the State in 1980 is 14 percent less than that found in 1954.
- The aspen forest type accounts for 41 percent of the commercial forest area.
- Farmers own more than three-fourths of the commercial forest land.

Inventory

- There is an average of 474 trees per acre of commercial forest land in the State.
- Cubic-foot volume in all live trees on commercial forest land totals 302.1 million cubic feet — 207.1 million cubic feet in growing-stock trees, 89.0 million cubic feet in cull trees, and 6.0 million cubic feet in salvable dead trees.
- Thirty-nine percent of the growing-stock volume is found in the aspen forest type; sawtimber volume is concentrated in the elm-ash forest type.
- On average, there are 603 cubic feet of growing stock per acre of forest land.
- Growing-stock volume on nonforest land with trees totals 419.4 million cubic feet.

Stand Conditions

- The majority of the commercial forest land is in stands less than 51 years old.
- On average, a fully stocked natural stand will produce 48 cubic feet of growth per acre per year at culmination of mean annual increment.
- The average site index in the State is 53.
- Net annual growth of growing stock is 7.7 million cubic feet, or 22 cubic feet per acre.
- Average annual growing-stock removals are 1.5 million cubic feet — 77 percent goes to other removals, 22 percent to roundwood products, and 1 percent to logging residue.
- Average annual growing-stock removals are only 20 percent of growth.
- Growing-stock mortality is 1.6 million cubic feet.
- Disease is the primary cause of mortality.

Thirty-Year Projections

- The low removals option shows growing-stock removals increasing from 1.5 million cubic feet in 1979 to 4.4 million in 2010; inventory increases from 207.0 million cubic feet in 1980 to 476.2 million in 2010.
- The high removals option shows growing-stock removals increasing from 1.5 million cubic feet in 1979 to 10.0 million in 2010; inventory increases from 207.0 million cubic feet in 1980 to 435.6 million in 2010.

Treatment Opportunities

- Of the commercial forest land, 176,000 acres were targeted for treatment during the decade 1980-1989.
- The most common treatment is harvest, for which 135,400 acres qualify.
- The 12,900 acres qualifying for thinning are concentrated in the elm-ash forest type.
- Of the 27,700 acres of commercial forest land qualifying for stand conversion or restocking, 17,200 acres are in the elm-ash forest type.

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A SECOND LOOK AT NORTH DAKOTA'S TIMBER LAND, 1980

Pamela J. Jakes
Associate Resource Analyst
and **W. Brad Smith**
Associate Mensurationist

TIMBER RESOURCE TRENDS

The prairies of North Dakota are best known for their capacity to produce abundant crops of wheat and barley. The scattered woodlands are not a dominant feature of the landscape, but they are very important. At the time of pioneer settlement in the mid 1800's, the natural woodlands of North Dakota covered about 700,000 acres. Today, there are 518,100 acres of land classified as forest. Land clearing for agriculture has been the dominant force in the decline. Even from the earliest settlers, however, North Dakotans have realized the value of trees for protecting their homes, crops, and livestock. Currently there are more than 384,400 acres of protective shelterbelts, windbreaks, and wooded strips in the State. Data were collected in the recent North Dakota forest survey to determine the extent and characteristics of these areas as well as the commercial forest resource.

Land Use in North Dakota and Trends in Land Use

Nonforest land occupies 99 percent of land

Resources Evaluation recognizes two primary categories of land use — forest and nonforest.[1] In North Dakota, only 1 percent of the total land area is forest land. Nonforest land accounts for 43.8 million acres of the total 44.3 million acres of land in the State (table 1). Two classes of nonforest land — cropland, and improved pasture and natural range — account for 93 percent of the total nonforest area.

[1]*Terms are defined in alphabetical order in the Appendix, page 28.*

Table 1. — *Area by land class and Forest Survey Unit, North Dakota, 1980*

(In thousand acres)

Land class	All units	Eastern	Western
FOREST LAND			
Commercial	343.2	283.7	59.5
Unproductive	148.0	49.2	98.8
Reserved	26.9	1.9	25.0
Total	518.1	334.8	183.3
NONFOREST LAND			
Nonforest with trees:			
Cropland	44.6	34.7	9.9
Improved pasture and natural range[1]	436.6	44.6	392.0
Wooded strips[2]	167.0	47.0	120.0
Windbreaks[3]	30.1	23.4	6.7
Shelterbelts[4]	187.3	135.8	51.5
Other	120.1	22.5	100.6
Subtotal	985.7	308.0	677.7
Nonforest without trees:			
Cropland	30,545.8	18,065.4	12,480.4
Improved pasture and natural range[1]	10,121.1	2,259.9	7,861.2
Other	2,168.6	1,240.2	928.4
Subtotal	42,835.5	21,565.5	21,270.0
Total	43,821.2	21,873.5	21,947.7
Total land area[5]	44,339.3	22,208.3	22,131.0

[1]Contains land classified as range by the Soil Conservation Service.

[2]An acre or more of natural continuous forest land that would otherwise meet survey standards except it is less than 120 feet wide.

[3]Planted or natural stand of trees more than 120 feet wide or larger than 1 acre used for the protection of buildings.

[4]Planted stands of trees less than 120 feet wide or smaller than 1 acre or both.

[5]U.S. Department of Commerce, Bureau of Census. 1970. Area Measurement reports, GE 20, No. 1, 22 p.

The total agricultural area represented by cropland and improved pasture and natural range is evenly split between eastern and western North Dakota (fig. 1). The imbalance of cropland in the east is offset by the larger proportion of improved pasture and natural range in the west.

Nonforest land with trees has many uses

Because almost all land in North Dakota is nonforest, a closer look at nonforest land with trees is in order. This land class is important because it provides protection for buildings, crops, and livestock; reduces wind and water erosion; and provides stabilization for streambanks. Much of the area classified as nonforest land with trees could be classified as commercial forest land except that the primary land use excludes timber management or the area is too small. The largest portion of nonforest land with trees is improved pasture and natural range, found primarily in the western part of the State (fig. 2).

Protective areas such as shelterbelts and windbreaks are primarily found in the east; the narrower wooded strips dominate in the more arid western portions of the State. State and Federal agencies participate in programs such as the Agricultural Conservation Program and the Great Plains Conservation Program which help establish shelterbelts and windbreaks (fig. 3). As the result of such plantings, the acreage of protective areas has increased since the 1954 survey. Protection of homes, livestock, soil, roads, pastures, crops, and wildlife is the primary function of these plantings, although incidental wood production, particularly for fuel, is a valuable byproduct.

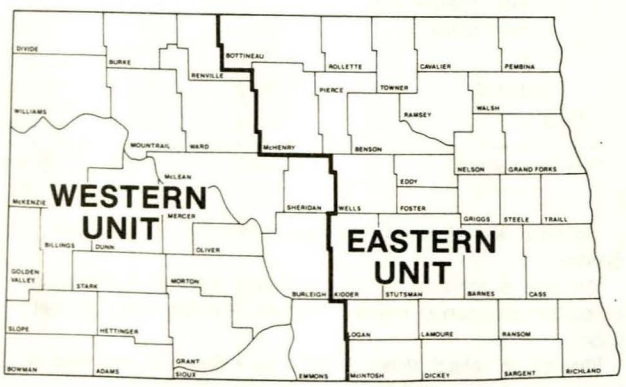

Figure 1. — *North Dakota Forest Survey Units, 1980.*

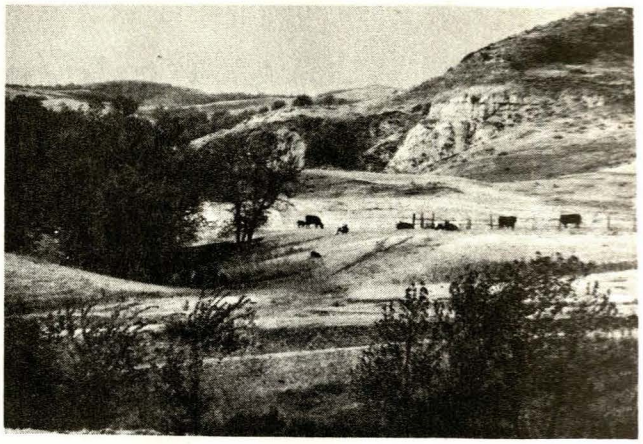

Figure 2. — *Improved pasture and natural range account for a large portion of the nonforest land with trees.*

The dominant tree species used for protective plantings in North Dakota are elm, ash, willow, cottonwood, spruce, juniper, and ponderosa pine. Common tall shrub species are Russian olive, crabapple,

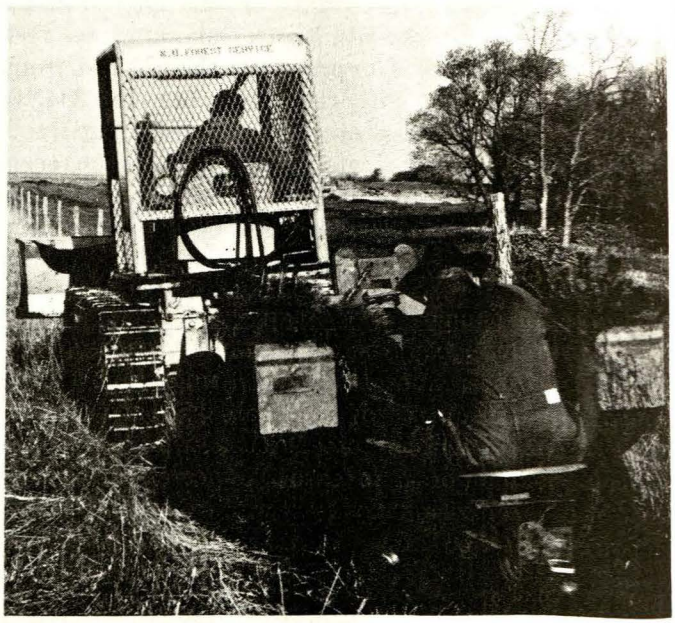

Figure 3. — *State and federal agencies participate in programs that help establish windbreaks and shelterbelts. (Photo courtesy of the North Dakota Forest Service.)*

chokecherry, and plum. Lower shrubs include Caragana, honeysuckle, lilac, and golden currant. Combinations of these trees and shrubs are often used. Although protective plantings are classified as nonforest, they play an important role in North Dakota forestry. North Dakotans recognize that trees and shrubs provide values far greater than their price as raw materials for products of wood or fiber.

Forest land declines between surveys

The area of forest land has declined 9 percent, from 572,000 acres in 1954 to 518,100 acres in 1980 (table 2). Forest land is subdivided into three land classes — commercial forest land, unproductive forest land, and reserved forest land. Forest inventories concentrate on collecting data on commercial forest land, because it is the portion of the land base that can support timber production. Commercial forest land is the largest class, accounting for 343,200 acres, or 66 percent of the forest land area in the State. Most forest land occurs in eastern North Dakota; five eastern Counties (Benson, Bottineau, Cavalier, Pembina, and Rolette) have 41 percent of the State total. Three Counties in the west (Billings, Dunn, and McKenzie) account for another 21 percent of the total.

Commercial forest land. — The 343,200 acres of commercial forest land reported in 1980 is 55,200 acres less than that reported in 1954 — an annual decline of -0.5 percent. This downward trend in commercial forest area is common throughout the Prairie States of Kansas, Nebraska, eastern South Dakota (east of the 103rd meridian), and North Dakota.[2] Clearing of land for agriculture is the primary cause for the decline in commercial forest acreage in North Dakota, but a large area has also been lost because of dam construction and the subsequent flooding of low-lying areas (fig. 4).

Noncommercial forest area. — The area of noncommercial forest land remained relatively constant during the 26 years between inventories. The 174,900 acres of noncommercial forest land reported in 1980 is 1,300 acres more than that reported in 1954. Within the noncommercial forest land class, the area of reserved lands increased sharply from 3,200 acres in 1954 to 26,900 acres in 1980, largely because of the transfer of unproductive forest land to parks and roadless areas. Unproductive forest land not in reserved status declined 13 percent between surveys, from 170,400 acres to 148,000 acres.

[2]*Data for Prairie States other than North Dakota came from: USDA Forest Service. 1980. An analysis of the timber situation in the United States, 1952-2030. Appendix 3.*

Table 2. — *Area by land use, North Dakota, adjusted 1954 and 1980*

(In thousand acres)

Land use	1954[1]	1980
FOREST		
Commercial	398.4	343.2
Noncommercial		
Unproductive	170.4	148.0
Reserved	3.2	26.9
Total	173.6	174.9
Total forest	572.0	518.1
NONFOREST	44,264.5	43,821.2
TOTAL LAND	44,836.5[2]	44,339.3[3]

[1]1954 data has been adjusted to be compatible with 1980 data due to change in inventory definitions and procedures.
[2]Census of Agriculture, 1950.
[3]Bureau of the Census, 1970.

Fifty-two percent of all noncommercial forest land in North Dakota is located in three western counties: Billings, Dunn, and McKenzie. Most of this land, classified as unproductive, is located in the Theodore Roosevelt National Park and the Little Missouri National Grassland.

Characteristics of North Dakota's Commercial Forest Land

Spotty distribution of commercial forest land

Fifty-five percent of all commercial forest land in North Dakota is concentrated in three areas — the Turtle Mountains (Bottineau and Rolette Counties), the Pembina Hills (Pembina and Cavalier Counties), and the Devils Lake area (Benson County). Another 30 percent is strung out along the bottoms of the Missouri, Red, and Sheyenne Rivers and their tributaries. The remaining area is in widely scattered patches across the State. Few counties in North Dakota have more than 1.0 percent of their land area classified as commercial forest and only one county (Rolette) exceeds 10 percent.

North Dakota's forest types

A forest type is a classification based on the species occupying the largest portion of an area of forest land. For example, commercial forest land classified as the aspen forest type is occupied primarily by aspen trees, but birch, balsam poplar, ash, and oak trees are also commonly found in the type.

Figure 4. — *Flooding resulting from dam construction eliminated more than 22,000 acres of commercial forest land between 1954 and 1980.*

Aspen forests dominate North Dakota's forest landscape, accounting for 41 percent of all commercial forest land (fig. 5). The type is concentrated in the Turtle Mountains and Pembina Hills where 103,100 of the 139,500 acres are found.

The second most dominant type in the State is elm-ash with 33 percent of all commercial forest land. This type is generally found in the low areas along rivers and streams.

The oak forest type accounts for 13 percent of the commercial forest area in the State. Bur oak, the principal species in this type, is indigenous to the drier ridges and southern slopes of the Pembina Hills and the Turtle Mountains, and to the area south of Devils Lake. These areas comprise 57 percent of all the oak type found in North Dakota.

Cottonwood and Plains hardwoods (forests in which basswood comprises a plurality of the stocking with

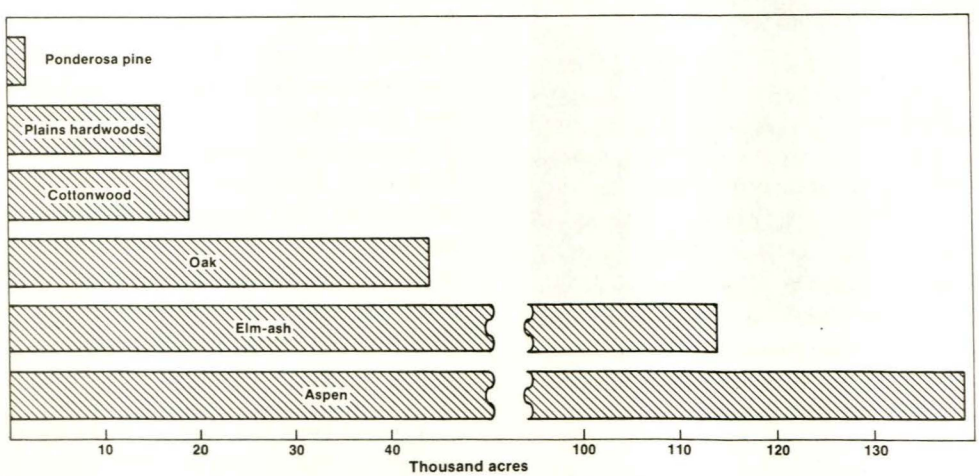

Figure 5. — *Area of commercial forest land by forest type, North Dakota, 1980. (Does not include 9,200 acres of nonstocked commercial forest land).*

elm and oak as common associates) each comprise about 5 percent of the commercial forest area. The cottonwood type is found almost exclusively in the river bottom areas of western North Dakota, the Plains hardwoods type is confined to the east, primarily to the eastern Canadian border counties and the Red River Valley.

Ponderosa pine, covering less than 1 percent of the commercial forest land in North Dakota, is the only commercial softwood type. It is found chiefly near the Little Missouri River south of the Theodore Roosevelt National Park. The largest concentration of this type is a 2,000-acre area on the south bank of the Little Missouri 10 miles north of Amidon. This area, once part of the Dakota National Forest, was sold by the government in 1917 because of high administrative costs. Today, most of it is owned by private individuals.

Rocky mountain juniper is found primarily in pure but noncommercial stands in the coulees and draws of the Badlands. Although juniper is not recognized as a forest type on commercial forest land in North Dakota, it is shown on the type map to indicate the concentrated areas of these pure stands.

Largest area of commercial forest land in poletimber

The area of poletimber stands accounts for 44 percent of all commercial forest land, with most of the total found in eastern North Dakota. Poletimber stands account for 47 percent of all commercial forest land in the east, but seedling and sapling stands predominate in the western half of the State. Land along reservoir areas is being regenerated (naturally and with help from the State's citizens), so much of the commercial forest land in the west is in seedling and sapling stands. Poletimber and seedling and sapling stands are concentrated in the aspen forest type; the elm-ash type accounts for many of the sawtimber stands (fig. 6).

Farmers are the dominant land owners

Farmers own more than three-fourths of the State's commercial forest land (fig. 7). Farmer-owned commercial forest land is predominately elm-ash and aspen forest types. Throughout the State, farmers own 92 percent of the sawtimber stands, 71 percent of the poletimber stands, and 69 percent of the seedling and sapling stands. Nearly one-fourth of the commercial forest land owned by farmers is held by individuals who own at least 100 acres of commercial forest land. Forty percent of the farmer-owned commercial forest land is owned by individuals with less than 5 acres. The size of the owner's holdings does not necessarily indicate the area of individual tracts of timber because one person may own several tracts.

Figure 6. — *Poletimber and sapling and seedling stands are concentrated in the aspen forest type. (Photo courtesy of the North Dakota Forest Service.)*

Private owners hold an additional 42,100 acres of commercial forest land, 80 percent of which is Indian land. The 39,500 acres of public commercial forest land is almost evenly divided between seedling and sapling stands (50 percent) and poletimber stands (44 percent). A few acres of State-owned land are in sawtimber stands.

Average stand age is 51 years

The majority of the commercial forest land in North Dakota is in stands less than 51 years old (fig. 8). The distribution of commercial forest land among stand-age classes varies by forest type. All aspen stands in the State are less than 81 years old, but more than 40 percent of the elm-ash stands are at least 81 years old. The oldest stands are found in the elm-ash, cottonwood, and Plains hardwoods forest types. Regeneration is occurring most frequently in the aspen and elm-ash forest types. Fifty-three percent of the sapling and seedling stands are in the aspen forest type and 36 percent are in elm-ash.

Site quality measures

Two measures of site quality were collected during the second North Dakota Forest Inventory. Site classes, expressed in cubic feet of growth per acre per year,

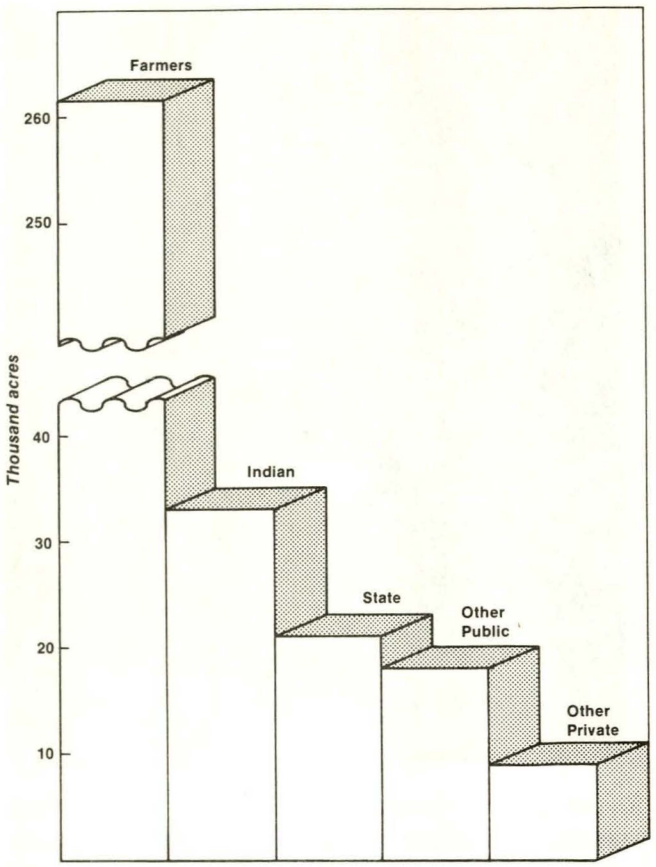

Figure 7. — *Area of commercial forest land by owner, North Dakota, 1980.*

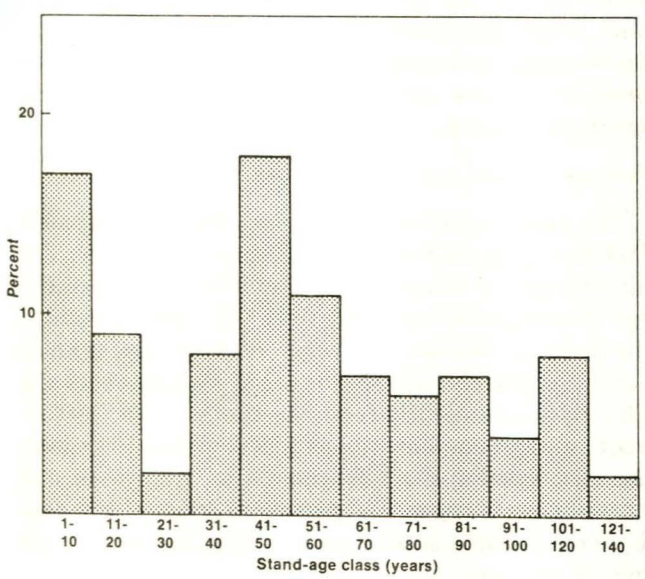

Figure 8. — *Distribution of commercial forest land by stand-age class, North Dakota, 1980.*

classify a site in terms of its inherent capacity to grow crops of industrial wood based on culmination of mean annual increment for fully stocked natural stands. On the average, a fully stocked stand in North Dakota will produce 48 cubic feet per acre per year at culmination of mean annual increment.

A second expression of site quality, site index, classifies sites in terms of the height of a free-growing dominant or codominant tree of a representative species of the forest type at age 50. The average site index in North Dakota is 53 feet. This means that on average a 50-year-old dominant or codominant tree in a stand will be 53 feet tall.

Site index varies widely by forest type. A site index that is excellent for one forest type would only be average for another type. For example, the average site index for cottonwood is 64 (fig. 9). The best oak sites in North Dakota fall into the 61-70 site index class. Therefore, in North Dakota, commercial forest land in the 61-70 site index class would be called excellent if it were supporting oak but only average if supporting cottonwood.

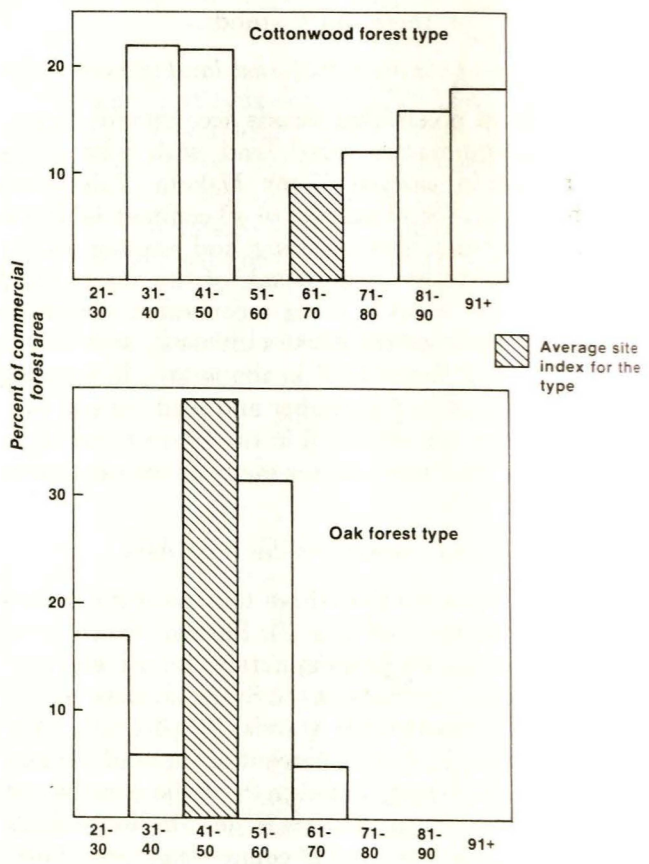

Figure 9. — *Distribution of commercial forest land by site index for cottonwood and oak forest types, North Dakota, 1980. (Although our sample did not show any cottonwood type with site index 51-60, there is probably some land in this class.)*

Roads provide easy access to forests

Many forested areas in the State can be easily reached by existing roads. Data from the second North Dakota Forest Inventory indicate that 95 percent of the commercial forest area is within 1 mile of a maintained road (fig. 10). There are 8,200 acres of oak and aspen forest types more than 10 miles from a road; the remaining 335,000 acres of commercial forest land are within 5 miles of a road.

Forest types vary in proximity to water

In North Dakota, vegetation is often limited by lack of water. During the second Forest Inventory, photo interpreters measured the distance of forested areas from the nearest stream (at least 120 feet wide), lake, or reservoir (at least 1 acre in area).

Nearly one-third of North Dakota's commercial forest land is within 1/8-mile of a lake or stream — where the relatively high water tables and spring flooding provide the water necessary for trees to survive (fig. 11). Proximity of forests to water is also vital for wildlife habitat and desirable for many recreational activities.

Average stand area is 47 acres

Stand area, a measure of the homogeneity of North Dakota's commercial forest land, shows the extent of a given forest type, stand-size class, and density. It is determined during aerial photo interpretation. Nearly one-third (107,400 acres) of the State's commercial forest land is in blocks of less than 4 acres; 18,600 acres are in homogeneous blocks of at least 160 acres.

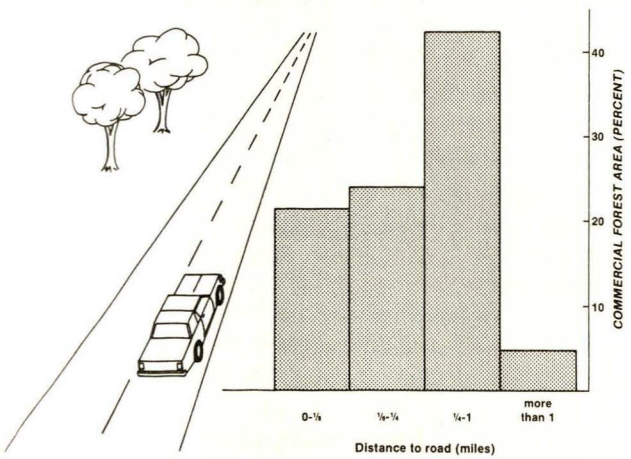

Figure 10. — *Distribution of commercial forest land by distance to road, North Dakota, 1980.*

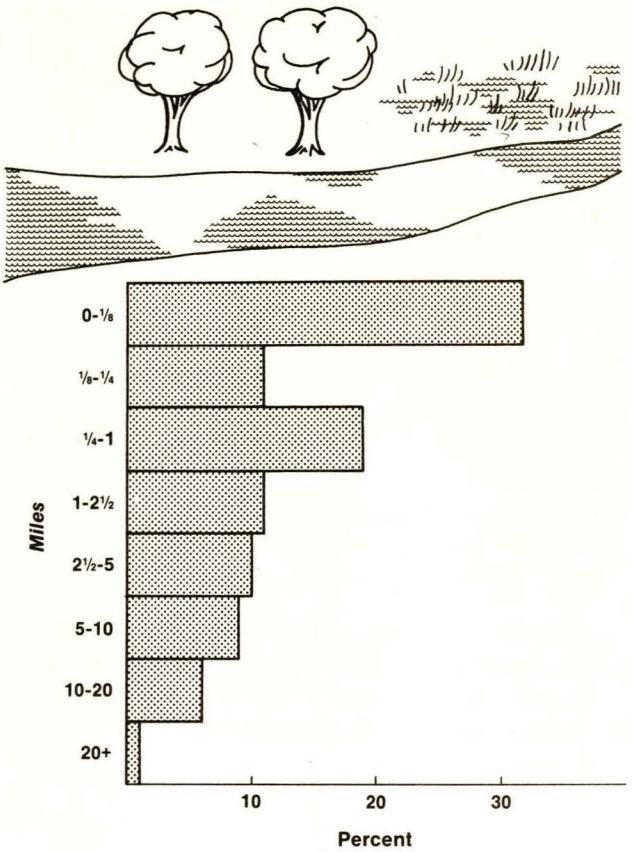

Figure 11. — *Distribution of commercial forest land by distance to water, North Dakota, 1980.*

Inventory and Number of Trees on Commercial Forest Land

Aspen is most common

More than 162.6 million live trees 1 inch in diameter and larger were found on North Dakota's 343,200 acres of commercial forest land, averaging 474 trees per acre. Aspen is the most common tree in the State, accounting for 38 percent of all live trees (fig. 12). The oak and ash species groups account for an additional 17 percent each.

When the total number of live trees in the State are plotted by diameter class, they form an inverse J-shaped curve, characteristic of a well-structured uneven-aged forest (fig. 13). It is necessary to have an abundance of young trees to ensure that enough will reach the size or quality desired by the forest owner or manager.

Of the total number of live trees, 27 percent are cull trees (rough and rotten or short log) and 73 percent are growing-stock trees. As trees grow larger (and older), they become more susceptible to rot and are

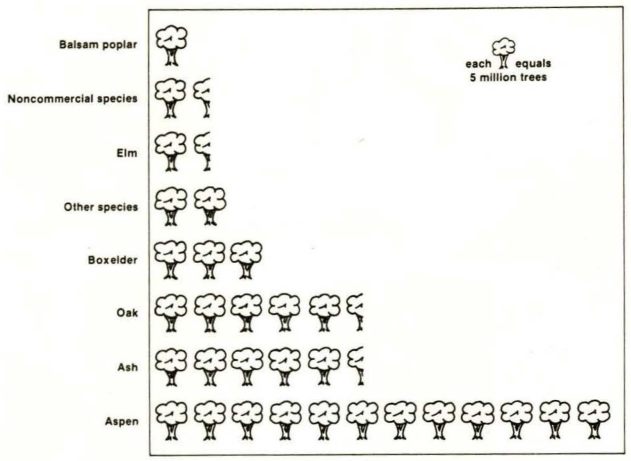

Figure 12. — *Number of all live trees 1 inch in diameter and larger by species group, North Dakota, 1980.*

more likely to be rough or have poor form, resulting in a cull classification. This is the case in North Dakota — 20 percent of the trees in the 2-inch diameter class are cull compared to 46 percent of the trees in the 12-inch class.

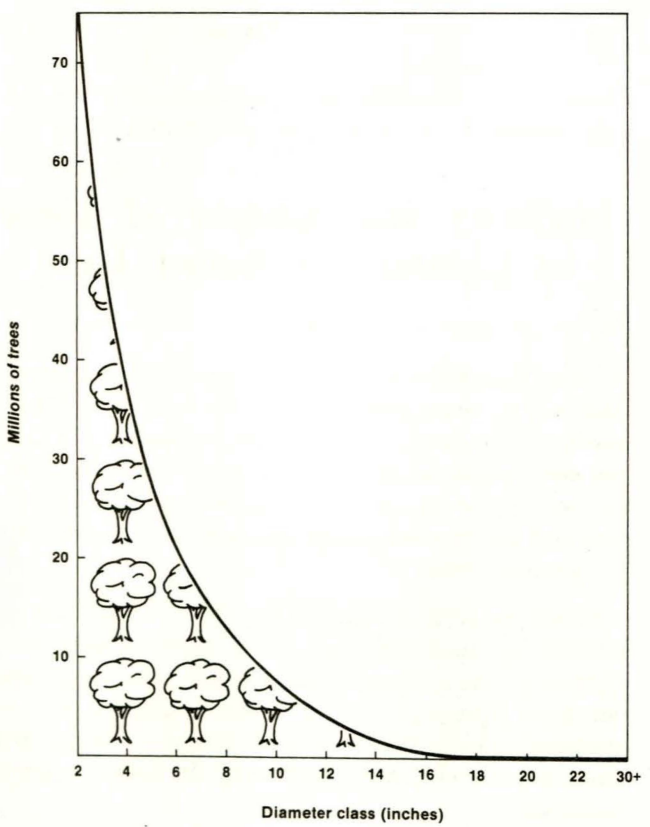

Figure 13. — *Number of all live trees 1 inch in diameter and larger by diameter class, North Dakota, 1980.*

Inventory concentrated in growing-stock trees

The cubic-foot inventory volume in all trees on commercial forest land totals 302.1 million cubic feet — 207.1 million in growing-stock trees, 89.0 million cubic feet in cull trees, and 6.0 million cubic feet in salvable dead trees (fig. 14). The proportion of total inventory in growing-stock trees (69 percent) is fairly consistent across the Plains States. The hardwood species have 68 percent of their 300.4 million cubic feet of live inventory in growing-stock trees, 25 percent in rough and rotten cull, 5 percent in short-log

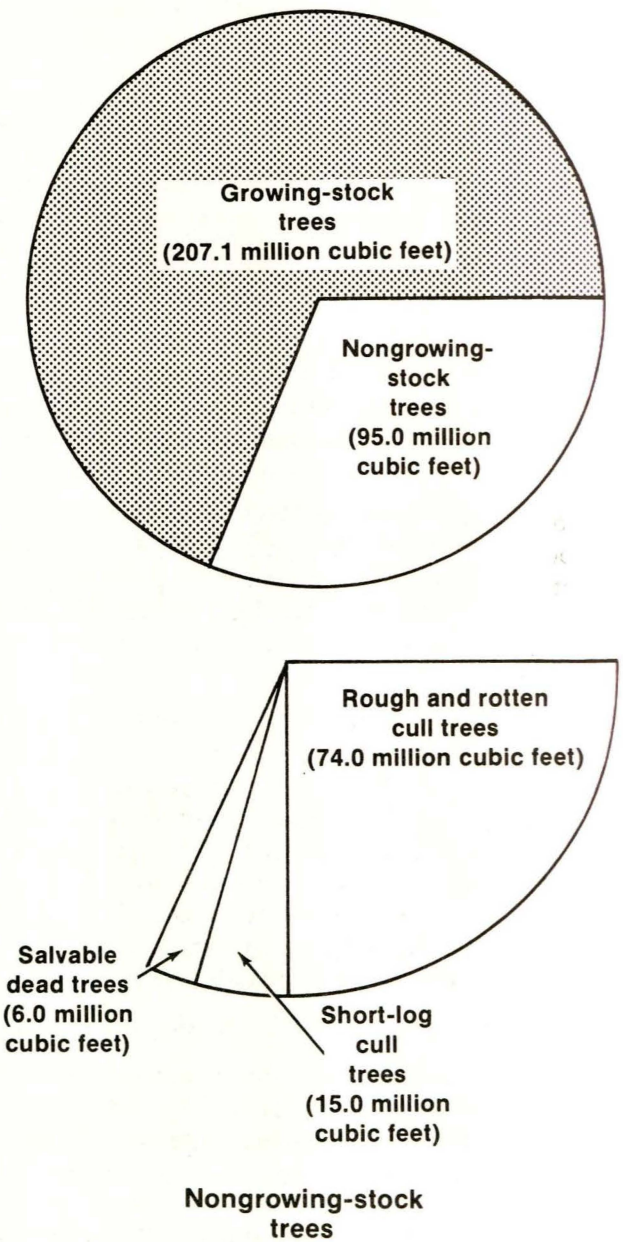
Growing-stock trees (207.1 million cubic feet)
Nongrowing-stock trees (95.0 million cubic feet)
Rough and rotten cull trees (74.0 million cubic feet)
Salvable dead trees (6.0 million cubic feet)
Short-log cull trees (15.0 million cubic feet)
Nongrowing-stock trees

Figure 14. — *Timber volume by class of timber, North Dakota, 1980.*

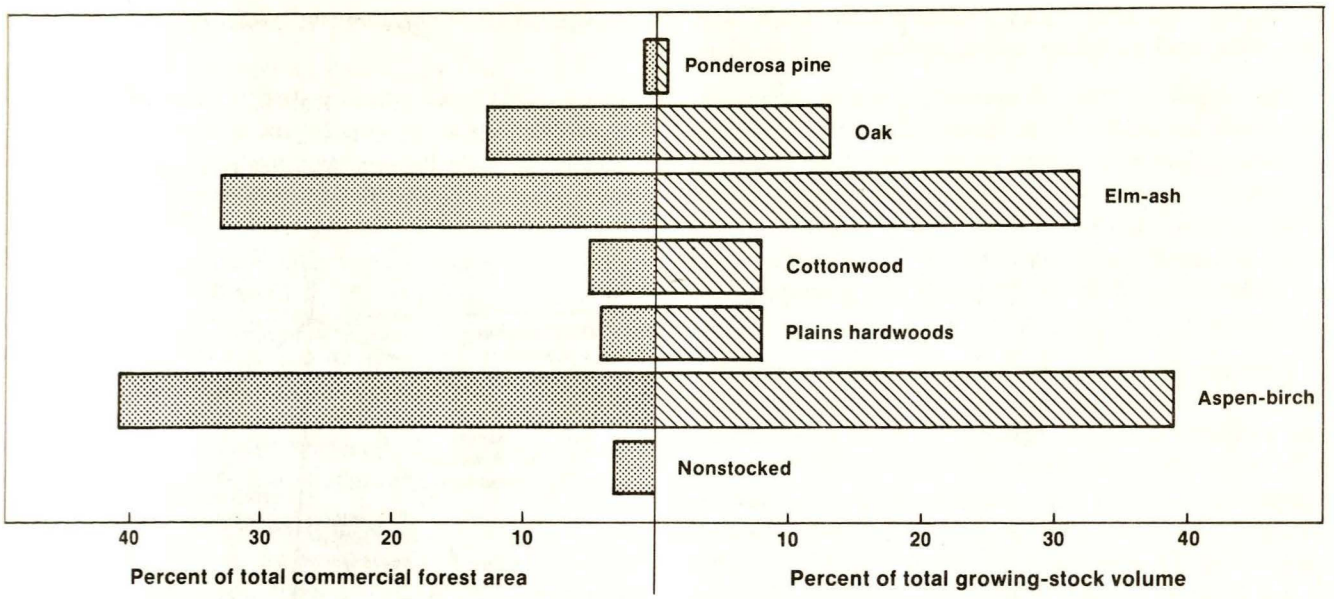

Figure 15. — *Distribution of commercial forest area and growing-stock volume by forest type, North Dakota, 1980.*

cull, and 2 percent in salvable dead trees. Most of the 1.8 million cubic feet of softwoods is in growing-stock trees, except for 98,100 cubic feet of rough and rotten cull.

Growing-stock inventory is composed of sawtimber and poletimber trees. Fifty-three percent of the North Dakota growing-stock inventory is in poletimber, 110.5 million cubic feet. Sawtimber trees account for 96.6 million cubic feet, equivalent to 509.9 million board feet.[3]

Just as the aspen forest type accounts for the largest portion of the commercial forest area, it holds the largest portion of North Dakota's growing-stock inventory (fig. 15). Sawtimber inventory, however, is concentrated in the elm-ash forest type. Fifty-five percent of the elm-ash stands are sawtimber size, compared to only 4 percent of the aspen stands. Aspen stands are concentrated in poletimber (63 percent) and sapling and seedling stands (33 percent).

Volumes per acre consistent with other Plains States

On average, there are 603 cubic feet of growing stock per acre of commercial forest land in North Dakota. Average sawtimber volume per acre is 1,486 board feet. The growing-stock inventory per acre in the State is consistent with that reported for eastern South Dakota and Nebraska, and slightly higher than that for Kansas. The highest growing-stock and sawtimber inventories per acre occur in the Plains hardwoods forest type:

Forest type	Growing-stock volume per acre (Cubic feet)	Sawtimber volume per acre (Board feet)
Ponderosa pine	807	1,501
Oak	597	1,060
Elm-ash	577	2,163
Cottonwood	896	3,732
Plains hardwoods	1,054	4,785
Aspen	574	492
Nonstocked	8	—
All types	603	1,486

The Plains hardwoods forest type is made up primarily of sawtimber stands at least 61 years old with high basal areas — these characteristics tend to produce high volumes per acre. The low sawtimber volumes per acre in the aspen forest type are the result of so little aspen in sawtimber-size trees.

Aspen predominates inventory

The total inventory volume in any forest type is the sum of the volumes in the various species composing the type. For example, the aspen forest type has 80.0 million cubic feet of growing-stock volume — 72 percent in aspen species. Twelve percent of the aspen

[3] *International 1/4-inch rule.*

forest type inventory is in balsam poplar; birch, oak, elm, ash, and boxelder are also found in the type.

The largest portion (29 percent) of the State's growing-stock inventory is in aspen (fig. 16). The 59.9 million cubic feet of aspen growing-stock inventory is concentrated on farmer-owned commercial forest land in trees less than 12 inches in diameter. Four other species groups — ash, elm, oak, and cottonwood — account for most of the remaining growing-stock inventory.

Hardwood growing-stock inventory occurs across a range of diameter classes, but the 10-inch diameter class holds the largest volume. Growing-stock inventory in trees more than 20 inches in diameter is generally found in the cottonwood or elm species groups. These two groups account for more than 44 percent of the sawtimber inventory (fig. 17). All softwood growing-stock inventory is in ponderosa pine less than 13 inches in diameter.

Volumes per acre vary by owner

As with commercial forest area, farmers hold most of North Dakota's growing-stock inventory (82 percent). However, the growing-stock inventory volumes per acre of commercial land vary widely by ownership class:

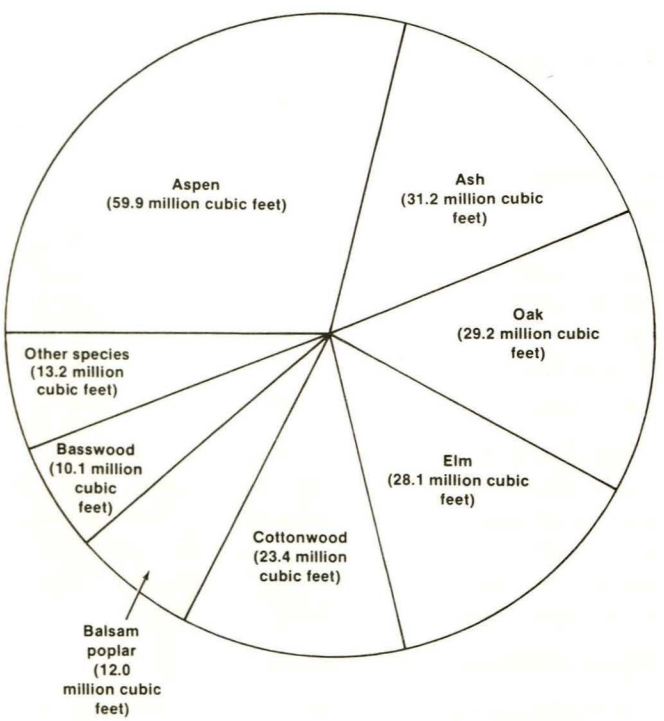

Figure 16. — *Net volume of growing stock on commercial forest land by species group, North Dakota, 1980.*

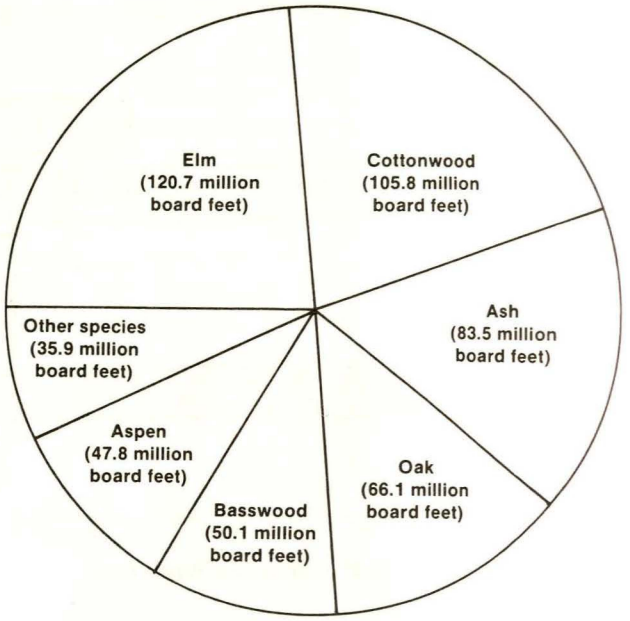

Figure 17. — *Net volume of sawtimber on commercial forest land by species group, North Dakota, 1980.*

Ownership class	Growing-stock volume per acre (cubic feet)
State	773
Farmer	648
County and municipal	588
Private individual	556
Miscellaneous federal	385
Indian	305
National forest	133
All owners	603

The lowest growing-stock inventory per acre, 133 cubic feet, occurs on National Forest land, because all National Forest stands are sapling and seedling stands with very little growing-stock inventory. The high growing-stock inventories per acre on State-owned land is in the aspen forest type, a type with very low average inventories per acre. However, the high growing-stock inventories per acre in this ownership class can be attributed to the higher quality sites on State-owned commercial forest land. For example, the average site class rating for this land is 67 cubic feet of growth per acre per year, 40 percent higher than the average for all commercial forest land in the State. The average site index for State-owned commercial forest land is 62, 17 percent higher than the average for all commercial forest land.

Biomass totals 16.3 million green tons

Biomass on commercial forest land in North Dakota totaled 16.0 million green tons of trees and 885,321

green tons of shrubs. Tree biomass is made up of 5 components:

1. **Growing-stock boles** — the total aboveground volume (including the bark) in growing-stock trees 5 inches in diameter and larger from a 1-foot stump to a variable 4-inch top diameter outside bark (t.d.o.b.);
2. **Growing-stock tops and limbs** — the aboveground volume (including the bark) in growing-stock trees 5 inches in diameter and larger from a 1-foot stump, excluding the growing-stock bole;
3. **Cull tree boles** — the aboveground volume (including the bark) in cull trees 5 inches in diameter and larger from a 1-foot stump to a 4-inch t.d.o.b.;
4. **Cull tree tops and limbs** — the aboveground volume (including the bark) of cull trees 5 inches in diameter and larger from a 1-foot stump, excluding the cull bole;
5. **1- to 5-inch trees** — the total aboveground volume (including the bark) of all trees 1 to 5 inches in diameter.

The largest portion of North Dakota's tree biomass is in growing-stock boles:

Component	Biomass (Million green tons)
1- to 5-inch trees	2.7
Growing-stock	
Boles	6.0
Tops and limbs	2.9
Cull	
Boles	2.8
Tops and limbs	1.6
All components	16.0

Shrub biomass is the total aboveground volume in shrubs and in trees less than 1 inch in diameter. In eastern North Dakota, shrub biomass averages 1,322 pounds per acre, concentrated in hazel. The average shrub biomass in western North Dakota is 1,134 pounds per acre, concentrated in honeysuckle (fig. 18).

Figure 18. — *The weight of the total aboveground volume in shrubs and in trees less than 1 inch in diameter averages 1,290 pounds per acre of commercial forest land.*

Net Annual Growth and Removals on Commercial Forest Land

Net annual growth averages 22 cubic feet per acre

Net annual growth of growing stock in North Dakota was 7.7 million cubic feet in 1979, or 22 cubic feet per acre. North Dakota's net annual growth per acre is

comparable to that reported in 1976 for Kansas, Nebraska, and eastern South Dakota. Growth rate is a term often used in comparing net annual growth in different States or among different species or ownership classes. Growth rate is the volume of growing-stock net annual growth divided by the volume of growing-stock inventory. Values generally run between 2 and 6 percent. The growth rate in North Dakota was 3.7 percent of inventory, again very close to the 3.3 percent average for the other three Plains States.

The majority of the net annual growth volume occurs in the aspen forest type. The 4.1 million cubic feet of aspen net annual growth averages out to 29 cubic feet per acre, or a rate of 5.1 percent. The ponderosa pine type exhibited the highest net annual growth per acre (46 cubic feet) and growth rate(5.7 percent). This high growth volume on so little commercial forest land was the result of much ingrowth, trees entering the poletimber class where they then count in determining growing-stock inventory.

Most of the growing-stock net annual growth occurs in trees less than 11 inches in diameter, where growth rates are on average much higher than in the larger diameter classes (fig. 19). In seedling and sapling or poletimber stands, because small increases in cubic foot volume represent large percentage increases in volume, the growth rates are higher than those found in sawtimber stands. High growth rates are common in species groups that have most of their trees in the smaller diameter classes (e.g., ponderosa pine, balsam poplar, aspen, and paper birch). A similar relation exists between stand age and the volume of net annual growth — the older the stand the lower the growth rate and the smaller the percent of the total net annual growth volume that occurs in the stand.

Farmer-owned commercial forest land accounts for 80 percent of the growing-stock net annual growth,

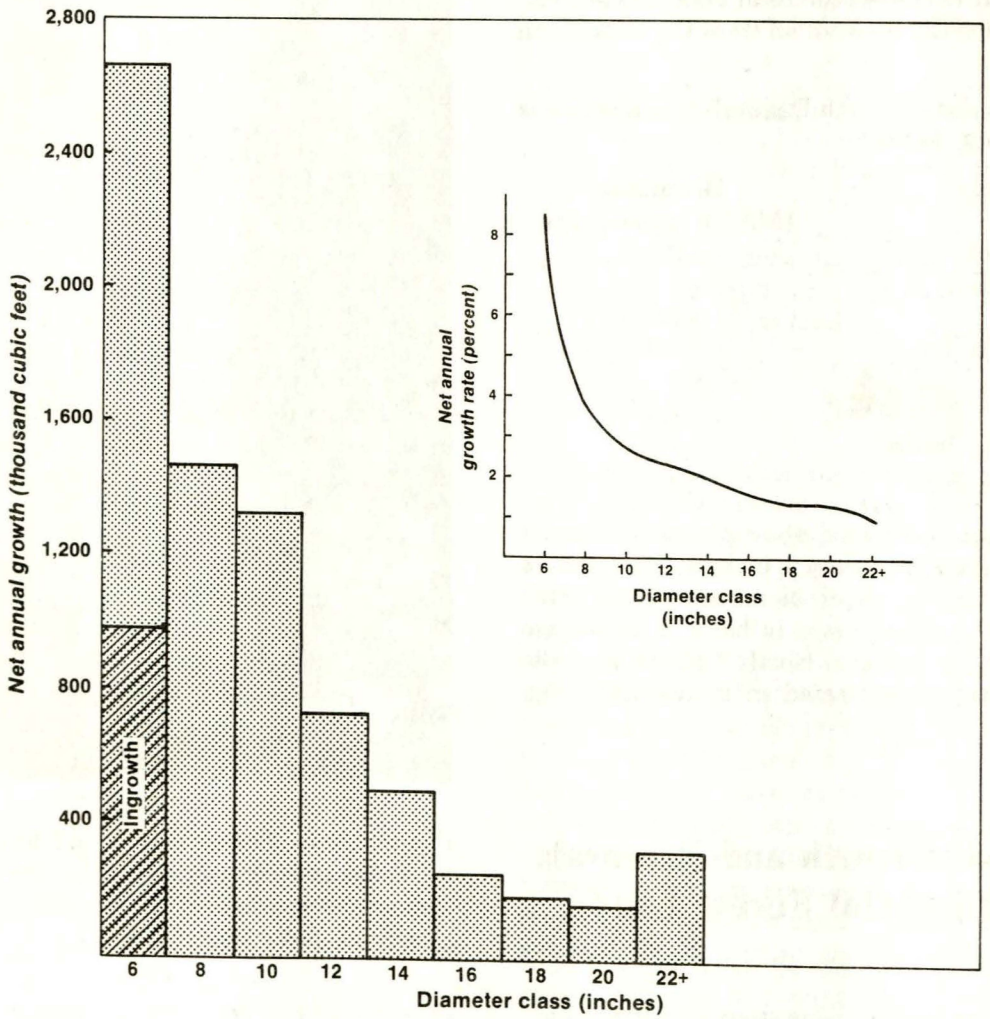

Figure 19. — *Net annual growth of growing stock and net annual growth rates on commercial forest land by 2-inch diameter class, North Dakota, 1979.*

but the young county- and municipal-owned forests and the State-owned forests have the highest volumes of net annual growth per acre (31 cubic feet and 30 cubic feet, respectively). The 6.5-percent growth rate on National Forest land, the highest rate of any ownership class, reflects the fact that all National Forest commercial forest land is in seedling and sapling stands.

Sawtimber growth totaled 30.2 million board feet. Although sawtimber volume is concentrated in the elm-ash forest type (48 percent of the total), the aspen type accounts for the largest portion of sawtimber growth. This is because aspen sawtimber stands fall into the lower end of the sawtimber diameter range (hardwood sawtimber trees must be at least 11 inches in diameter) where growth rates are higher.

Twenty percent of total removals go to products

Average annual growing-stock removals on commercial forest land totaled 1.5 million cubic feet in North Dakota in 1979. Of this total, 77 percent went to other removals, 22 percent went to roundwood products, and 1 percent went to logging residue (fig. 20).

The 1.2 million cubic feet of other removals represent trees that were removed from the commercial forest land base but not utilized for products. Other removals would include trees lost due to reservoir flooding, trees left standing but removed from the commercial forest land base due to changes in land use (e.g., commercial forest land being reclassified as productive-reserved forest land), and trees removed during timber stand improvement work but not utilized.

Growing-stock removals for roundwood products totaled 323,000 cubic feet. Fuelwood accounted for most of the roundwood product output (61 percent), followed by saw logs (36 percent) and posts (3 percent).

Aspen removals totaled 567,000 cubic feet, 38 percent of the total; oak and cottonwood together contributed another 493,000 cubic feet. Average annual removals from ponderosa pine totaled 7,000 cubic feet.

Sawtimber average annual removals totaled 2.9 million board feet in 1979 (fig. 21). Again, most of the removals volume was lost to other removals; only 41 percent of total sawtimber removals went to roundwood products. Saw logs accounted for more than half of the roundwood products removals. Cottonwood removals made up one-third of the total sawtimber removals; aspen and oak each made up an additional 18 percent.

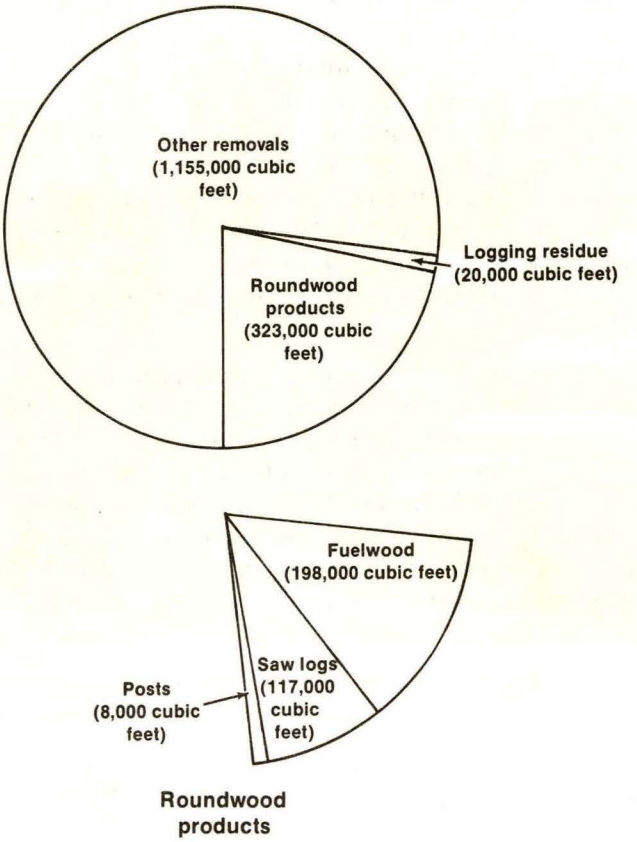
Other removals (1,155,000 cubic feet)
Logging residue (20,000 cubic feet)
Roundwood products (323,000 cubic feet)
Fuelwood (198,000 cubic feet)
Saw logs (117,000 cubic feet)
Posts (8,000 cubic feet)
Roundwood products

Figure 20. — *Average annual growing-stock removals on commercial forest land by item, North Dakota, 1979.*

Removals are 20 percent of growth

Net annual growth and average annual timber removals are often compared to determine whether a stand is being fully utilized. Although many silvicultural and economic factors influence recommended harvest levels, annual removals can generally equal the volume of net annual growth without depleting the forest resource. In North Dakota, removals were only 20 percent of growth in 1979. The oaks were the most fully utilized species group — removals were more than 44 percent of growth (fig. 22). Elm was the most underutilized species group — removals were only 7 percent of growth.

Mortality on Commercial Forest Land

In North Dakota, growing-stock mortality totaled 1.6 million cubic feet in 1979. Aspen species accounted for 59 percent of the total growing-stock mortality. Ash accounted for almost one-third of the 2.8 million board feet of sawtimber mortality.

Figure 21. — *Sawtimber average annual removals totaled 2.9 million board feet in 1979. (Photo courtesy of the North Dakota Forest Service.)*

The cause of mortality differs for growing stock and sawtimber. Disease is a primary cause in both cases, but animals play a larger role in sawtimber mortality than in growing-stock mortality. The animal damage in sawtimber is probably due to grazing.

Inventory on Nonforest Land with Trees

In contrast to most north-central States, North Dakota's growing-stock inventory on nonforest land adds significantly to the total forest resource picture. Although growing-stock inventories per acre on nonforest land with trees are less than that found on commercial forest land, the many acres in this land use category make the total inventory very high.

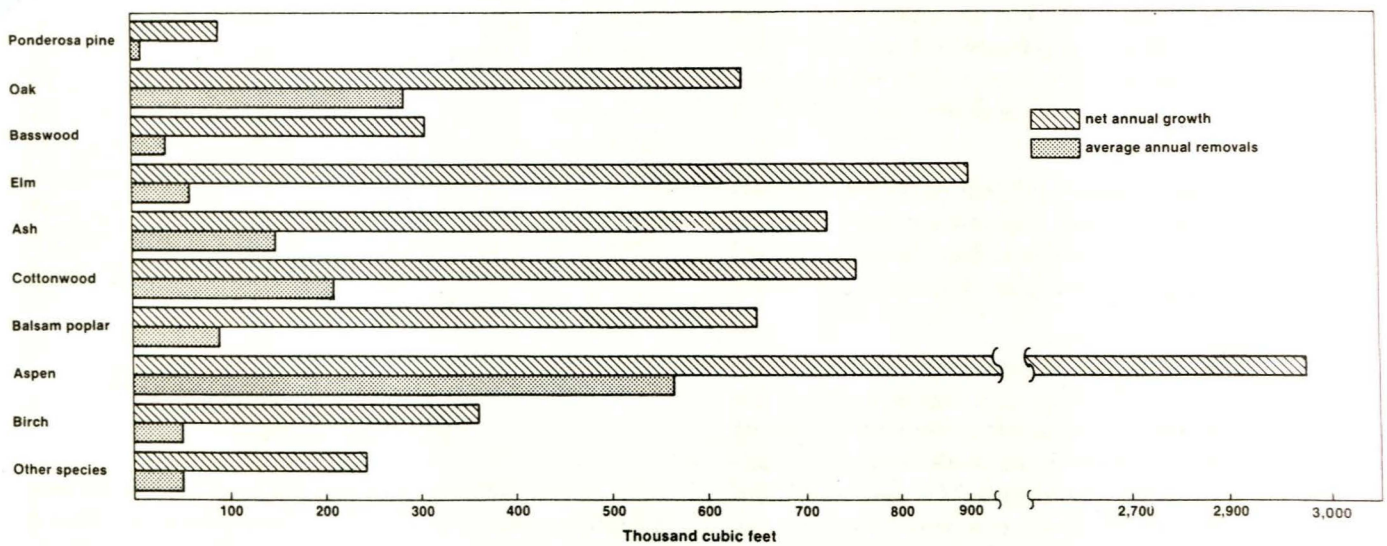

Figure 22. — *Net annual growth and average annual removals of growing stock on commercial forest land by species group, North Dakota, 1979.*

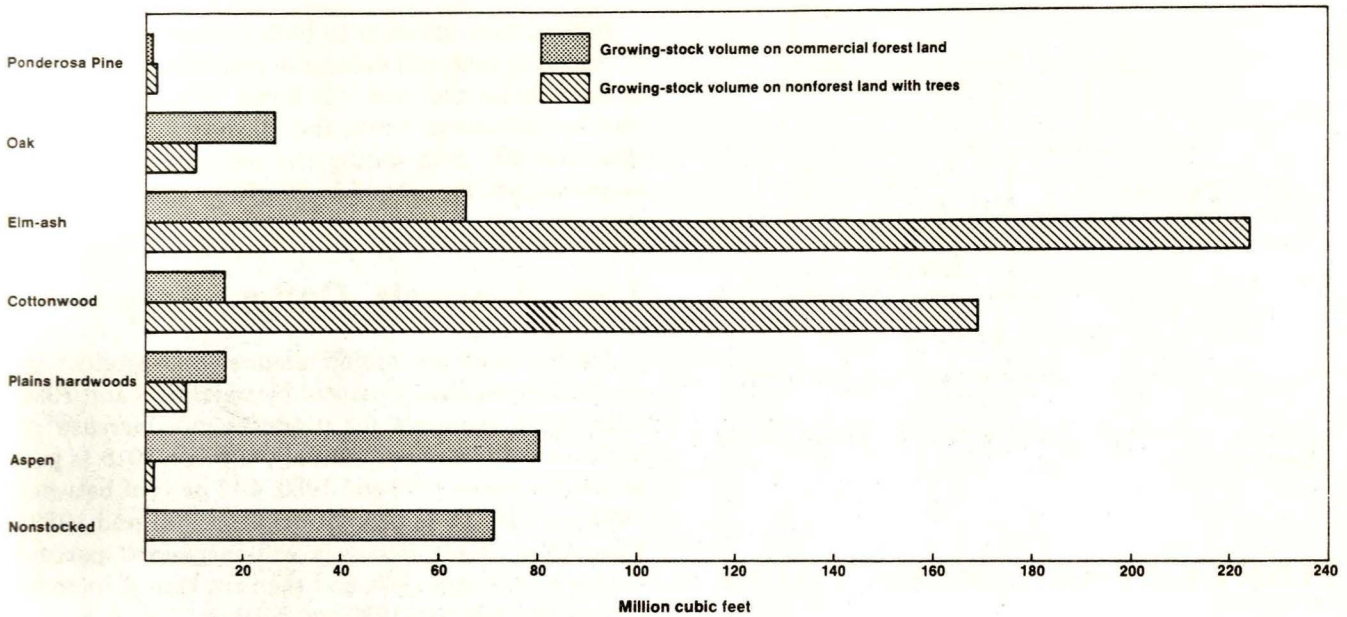

Figure 23. — *Net volume of growing stock on commercial forest land and on nonforest land with trees by forest type, North Dakota, 1980.*

Growing-stock inventory on nonforest land with trees is estimated at 419.4 million cubic feet (fig. 23). When this inventory is added to that on commercial forest land, total growing-stock inventory in the State triples to 626.5 million cubic feet. The elm-ash forest type holds the largest portion of the growing-stock inventory on nonforest land with trees:

Forest type	Growing-stock inventory volume (Million cubic feet)
Ponderosa pine	2.5
Oak	10.8
Elm-ash	224.2
Cottonwood	169.6
Plains hardwoods	8.0
Aspen	1.5
Exotic	2.6
Nonstocked	0.2
All types	419.4

TIMBER PRODUCTS OUTPUT

In 1977, 27 wood-using plants employing about 400 people were in operation in North Dakota. These plants produced $18.9 million worth of products, according to the 1977 Census of Manufacturers.[4] One-fourth of the wood-processing facilities in the State are primary industries — industries that do not produce a finished product. The eight primary processing plants are located principally in the Turtle Mountains area and along the Missouri and Red River Valleys (fig. 24). The others, secondary industries, are involved in producing finished goods such as millwork, trusses, cabinets, furniture, pallets, prefabricated buildings, and mobile homes.[5] Much of the raw material for these secondary operations comes from outside the State.

Timber product output totaled 579,000 cubic feet in 1977. Although cutting of timber for posts, lumber, and fuelwood has declined sharply since 1954, more wood is still used for fuel (77 percent) than for any other product. The current energy situation has undoubtedly contributed to fuelwood's continued dominance as the number one timber product in North Dakota. Nearly all the output came from roundwood products; only 19,000 cubic feet came from plant byproducts. Fifty-eight percent of all plant residues were utilized, and nearly one-third of this material was used for fuel.

[4] *U.S. Department of Commerce. 1977. Census of Manufacturers, North Dakota. Geographic Series MC 77-A-35, p. 35-38.*

[5] *North Dakota Business and Industrial Development Department, North Dakota Manufacturers Directory, 1980-1981.*

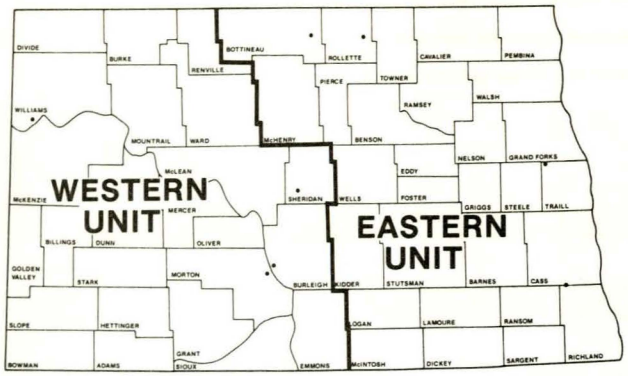

Figure 24. — *Primary wood-processing plants, North Dakota, 1980.*

THIRTY-YEAR PROJECTIONS

The U.S. Forest Service's recently completed RPA assessment of the Nation's forest and rangeland renewable resources shows that demand for most forest products will increase rapidly over the next 50 years.[6] This rising demand is in response to projected increases in population, economic activity, and income, and in response to continuing trends (1950-1976) in stumpage and timber prices. The demand for timber from the Nation's forests is expected to jump from 13.3 billion cubic feet in 1976 to 22.7 billion in 2030.

Although North Dakota's timber resources will not play a large role in meeting the Nation's future timber upply or affecting future demand, a comparison of he State's timber outlook with the Nation's is appro-riate. In addition, if forest managers and planners in the State can project what is likely to happen to the State's forests under differing levels of removals, they can modify current forest practices or timber marketing strategies, if necessary.

Through computer simulation, we were able to look into North Dakota's future and project forest conditions in the year 2010 for two levels of timber removals. The stand projection technique we used requires as input (1) the number of all live trees by 2-inch diameter class, (2) radial growth by 2-inch diameter class, (3) mortality rates by 2-inch diameter class, (4) removals rates by 2-inch diameter class, (5) total removals for each year of the projection, and (6) ingrowth into the 2-inch diameter class.

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[6]*U.S. Department of Agriculture, Forest Service. 1980. An analysis of the timber situation in the United States, 1952-2030.*

Assumptions common to both projections include: (1) radial growth will decline in response to increases in basal areas per acre, (2) forest management will continue at current levels, and (3) the volume of other removals will drop during the period as utilization improves, and the rate of decline in commercial forest area slow.

Low Removals Option Projection

The low removals option assumes that product removals will increase 4 percent between 1979 and 1980; after 1980, removals for products will increase an additional 0.17 percent annually through 2010 (e.g., 4 percent between 1979 and 1980, 4.17 percent between 1980 and 1981, 4.34 percent between 1981 and 1982). Meanwhile, other removals will increase 3 percent between 1979 and 1980, and then the rate of increase will decline between 1980 and 2010 (fig. 24). A decline in the rate of increase in other removals reflects the belief that North Dakota's forest resources will be utilized more completely during the projection period and that the decline in commercial forest area will stabilize.

The low removals option projection shows growing-stock removals increasing from 1.5 million cubic feet in 1979 to 4.4 million cubic feet in 2010 (fig. 25). Growing-stock net annual growth rises sharply during the first 10 years of the cycle, then levels off at around 12 million cubic feet in 1995, and remains at that level. Growing-stock inventory increases 130 percent between 1980 and 2010. Increased removals and a stable volume of net annual growth will eventually slow the increase in inventory, but as long as growing-stock net annual growth is higher than removals, inventory will build.

High Removals Option Projection

The high removals option assumes that product removals will increase 8 percent between 1979 and 1980 and then increase an additional 0.24 percent annually through 1990 (fig. 26). Beginning in 1991, removals will increase 0.12 percent annually through the projection period. Other removals will increase by 3 percent between 1979 and 1980 and then increase by progressively smaller amounts. By the last 3 years of the projection, other removals will be fairly constant.

The high removals option projection shows growing-stock removals increasing from 1.5 million cubic feet in 1979 to 10.0 million cubic feet in 2010. Again, growing-stock net annual growth rises steadily the

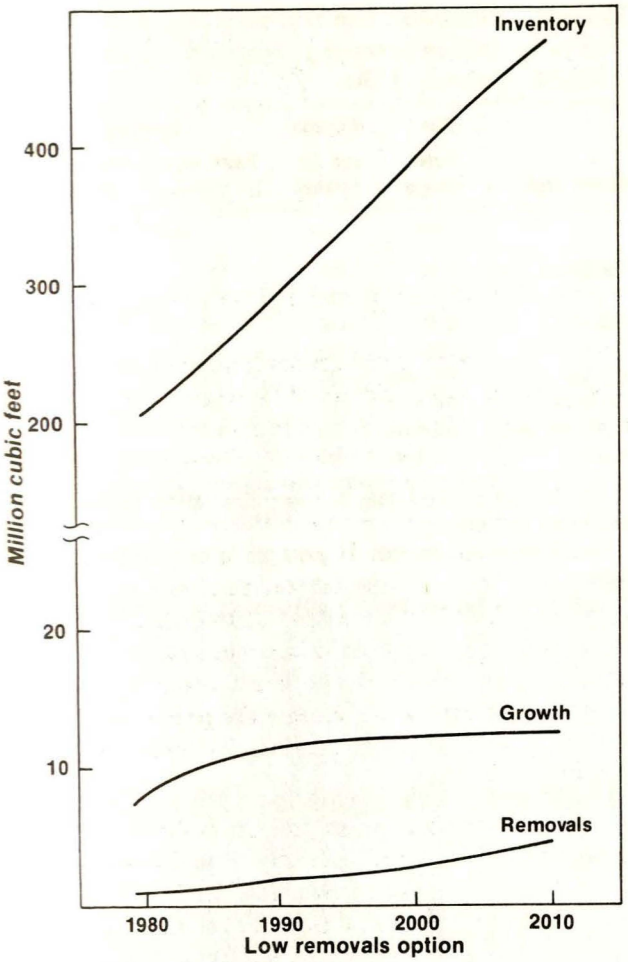

Figure 25. — *Removals, net annual growth, and inventory of growing stock on commercial forest land in North Dakota, 1980, and low removals option projections for 1981-2010.*

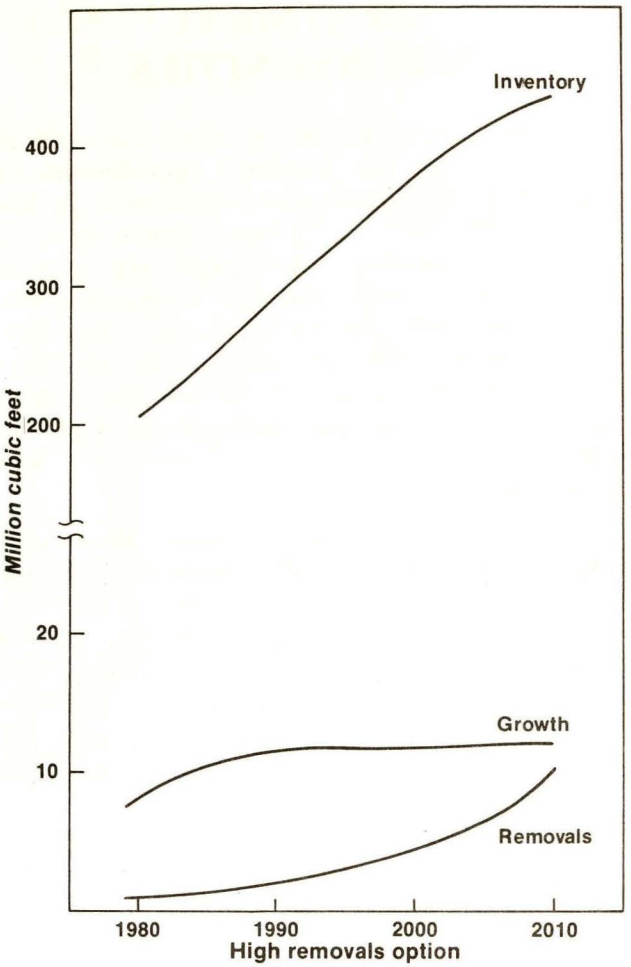

Figure 26. — *Removals, net annual growth, and inventory of growing stock on commercial forest land in North Dakota, 1980, and high removals option projections for 1981-2010.*

first 10 years of the projection period. After 1990, net annual growth levels off at between 11.5 and 12.0 million cubic feet. The interaction between net annual growth and removals has a dampening effect on inventory. Between 1980 and 1995, growing-stock inventory increases fairly steadily; however, after 1995, the rate of increase in growing-stock begins to decline. If the 30-year high option projection trends in growing-stock net annual growth and removals continue beyond 2010, growing-stock inventory will level off and eventually decline.

Meaning of the Projections

These 30-year projections are just two of many harvest scenarios possible for North Dakota. What actually occurs over the next 30 years will probably fall somewhere between the two options presented here. Because of the many uncertainties affecting the projections, the data are probably most meaningful for the first decade.

The data show that North Dakota can support an increase in growing-stock removals while continuing to build growing-stock inventory. It is up to forest managers and planners in the State to decide how best to use this information to meet North Dakota's future forest resource needs.

These estimates will be conservative if management of North Dakota's forests intensifies. The projections were done for the State as a whole, but removal decisions for each timber stand must be based on the stand's physical characteristics and silvicultural needs as well as on economic criteria.

TREATMENT OPPORTUNITIES

To help evaluate renewable resource investment options, we identified treatment opportunities for projected North Dakota forest conditions in the decade 1980-1989. The treatments evaluated were: (1) harvest, (2) thinning (commercial and precommercial), and (3) stand conversion or restocking. Projected stand conditions were compared to treatment criteria and the area qualifying for each treatment during the decade was determined. Volumes in stands selected for treatment were tabulated; they represent volumes that could be removed if treatments were carried out.

Treatment criteria for North Dakota were adopted from criteria identified in other north-central States. Representatives from the North Dakota Forest Service, and the State and Private Forestry and the National Forest System branches of the USDA Forest Service adapted the criteria to the State (table 3).

Treatment opportunities vary according to the criteria specified. Our findings stem from just one of many possible sets of treatment options.

Assumptions

To conduct the analysis, three assumptions were made: (1) the area of commercial forest land will remain stable for the decade 1980-1989, (2) all commercial forest land is available for treatment, and (3) a ready market exists for all species and products. The analysis did not take into account possible economic, social, or political constraints on treatment opportunities.

Method

As mentioned earlier, three broad treatment categories were identified for North Dakota: (1) harvest, (2) thinning (commercial and precommercial), and (3) stand conversion or restocking. Harvest cuts are final cuts. Harvest acreage is not included in the stand conversion or restocking category, because it was assumed that harvest is followed by artificial or natural regeneration.

The logic used to assign treatments to each forest inventory plot is described in detail in the Appendix.

Table 3. — *Harvest and timber stand improvement criteria used in assessing treatment opportunities, North Dakota, 1980*

Forest type	Site index range	Rotation age for harvest	Thinning[1]	
			Basal area for thinning	Post thinning basal area
	Feet	*Years*	*Square Feet*	
Ponderosa pine	0-50	100	110	80
	51+	120	110	80
Oak	0-55	110	90	[2]65
	56+	80	90	[3]65
Elm-ash	All sites	80	90	70
Cottonwood	All sites	60	95	60
Plains hardwood	All sites	90	90	65
Aspen	All sites	40	—	—

[1]Stands must be more than 10 years from harvest age to be considered for thinning.
[2]Stands must be less than 41 years old to be considered for thinning.
[3]Stands must be less than 51 years old to be considered for thinning.

Harvest Treatment Opportunities

Area

According to the treatment criteria used in this analysis, 135,400 acres of commercial forest land could be harvested by 1989 (table 4). More than half of this acreage is found in the aspen forest type. Ponderosa pine is the only forest type that has no stands ready for harvest.

Table 4. — *Area of commercial forest land qualifying for treatment by forest type and treatment class, North Dakota, 1980-1989*

(In thousand acres)

Forest type	All classes	Treatment class			
		Harvest	Thinning	Stand conversion or restocking	No treatment
Ponderosa pine	2.1	—	—	—	2.1
Oak	44.2	1.7	—	—	42.5
Elm-ash[1]	122.9	49.4	9.9	17.2	46.4
Cottonwood	18.7	5.1	3.0	3.4	7.2
Plains hardwood	15.8	7.3	—	—	8.5
Aspen	139.5	71.9	—	7.1	60.5
All types	343.2	135.4	12.9	27.7	167.2

[1]Includes 9,200 acres of nonstocked commercial forest land.

Many stands in North Dakota are mature and in need of harvest (fig. 27). More than 51 percent of the State's total aspen acreage qualified for harvest as did 46 percent of the Plains hardwoods acreage and 40 percent of the elm-ash acreage. In the elm-ash forest type many stands are overmature; 31 percent of the area consists of stands more than 10 years past rotation age.

Nearly one-third of the stands in the harvest category are found on sites with site index of more than 60. Most high site harvest areas are found in the aspen forest type. The low site areas are commonly elm-ash stands. The average area of a stand selected for harvest is 55 acres (table 5). More than 32 percent of the harvest area is in stands of at least 40 acres; 18 percent of the area is in stands of more than 80 acres.

Figure 27. — *Nearly 40 percent of North Dakota's commercial forest land is at or exceeds recommended rotation ages. (Photo courtesy of the North Dakota Forest Service.)*

Volume

Timber volume on commercial forest land selected for harvest totals 142.7 million cubic feet during the decade, 116.9 million cubic feet in growing-stock trees:

Tree class	Ten-year harvest volume (Million cubic feet)
Growing-stock	116.9
Cull	
Short-log	4.2
Rough and rotten	18.3
Salvable dead	3.3
All classes	142.7

The volume of salvable dead trees is the estimated mortality on the plots scheduled for treatment during the decade. Harvesting those trees that are projected to die during the decade will salvage 3.3 million cubic feet of timber that would have otherwise been lost.

An average of 864 cubic feet of growing stock would be removed for every acre of commercial forest land harvested. Growing-stock removals per acre are higher in the oak forest type than in any other type:

	Removals per acre (Cubic feet)
Ponderosa pine	—
Oak	1,824
Elm-ash	632
Cottonwood	804
Plains hardwoods	1,027
Aspen	987
All types	864

Table 5. — *Area of commercial forest land qualifying for treatment by stand area class and treatment class, North Dakota, 1980-1990*
(In thousand acres)

Stand Area class (acres)	All treatments	Treatments			
		Harvest	Thin	Stand conversion or restocking	No treatment
1-4	107.4	32.1	8.7	9.0	57.6
5-9	50.0	19.3	—	4.0	26.7
10-19	43.1	16.2	—	2.3	24.6
20-39	47.4	24.4	2.5	5.1	15.4
40-79	41.8	19.5	1.7	3.9	16.7
80-159	34.9	13.4	—	3.4	18.1
160-319	8.9	6.4	—	—	2.5
320-639	9.7	4.1	—	—	5.6
more than 640	—	—	—	—	—
All classes	343.2	135.4	12.9	27.7	167.2

The aspen forest type, 53 percent of the harvest area, holds 61 percent of the growing-stock harvest volume.

The majority of the growing-stock harvest volume is found in sawtimber trees. Aspen species account for nearly one-half of growing stock targeted for removal.

Thinning Treatment Opportunities

Area

Only 12,900 acres of commercial forest land qualified for thinning over the decade. The elm-ash and cottonwood forest types were the only types to have stands in need of thinning — 9,900 acres and 3,000 acres, respectively.

All thinned stands were less than 51 years old. The average site index of stands selected for thinning was 60. The 3,000 acres of cottonwood requiring thinning were all in site index class 81-90. Although most of the thinned area is in stands of less than 5 acres, 4,200 acres of elm-ash are in stands of at least 20 acres.

Volume

Volumes from thinnings total 4.1 million cubic feet for the decade, 3.0 million cubic feet in growing-stock trees. The average growing stock removed during thinnings is 231 cubic feet per acre thinned. Most (89 percent) of the thinned growing-stock volume is in poletimber trees. Cottonwood trees account for a majority of the volume.

Stand Conversion or Restocking Treatment Opportunities

Area

In North Dakota, 27,700 acres of commercial forest land is so poorly stocked that it has been targeted for stand conversion or restocking during the decade. These stands are found in the elm-ash (17,200 acres), aspen (7,100), and cottonwood (3,400) forest types.

Although stands in this treatment class are found in a range of stand-age classes, nearly half are more than 80 years old. The average site index of stands selected for stand conversion or restocking is 50; 3,400 acres of cottonwood have a site index of at least 91. The majority of the area is in stands of less than 20 acres.

Volume

By clearcutting these stands before stand conversion or restocking, 15.1 million cubic feet could be recovered during the decade — 11.9 million cubic feet in growing-stock trees. This averages to 430 cubic feet of growing stock removed per acre undergoing conversion or restocking. Most growing-stock volume removed is in sawtimber trees.

Discussion

According to the criteria used in this analysis, 176,000 acres of commercial forest land (51 percent) could receive some treatment during the decade 1980-1989. Because much of the area in any forest type is found in the Turtle Mountains and Pembina Hills, most treatment options are concentrated in these areas. The most common treatment is harvest, occurring on 135,400 acres during the decade. In several forest types, more than 40 percent of the commercial forest area is harvested — aspen (52 percent), Plains hardwoods (46 percent), and elm-ash (40 percent).

Most stands more than 90 years old could be harvested. The stands older than 90 years but not in this category were targeted for stand conversion or restocking, because they are poorly stocked with growing-stock trees.

Most areas selected for treatment are on sites with a site index less than 61. If priorities were assigned, treatments on high quality sites would be undertaken first because these sites would be expected to return a higher yield per dollar invested. The 3,400 acres of cottonwood in the site index class 91 + targeted for stand conversion or restocking may be such an opportunity. This cottonwood is on a high quality but underutilized site.

Besides quality, site size also affects treatment priorities. For very small areas, it may not be economical to transport the equipment or personnel necessary for treating them. For example, 3,000 acres of cottonwood in site index class 81-90 qualify for thinning. It would appear, from the standpoint of site quality, that this thinning operation would be high priority. However, the data show that the entire 3,000 acres are in stands of 1 to 4 acres.

The harvest opportunities identified here will not result in a sustained yield or even-flow of timber volume from North Dakota's forest land. The annual harvest area and volume under even-flow management would be less than that shown here. The area that could be harvested annually under an even-flow concept can be estimated by taking the total number of acres in a forest type and dividing it by the rotation age. For example, with the aspen forest type, the annual harvest area for even-flow management would be about 3,400 acres per year, as opposed to the 7,200 acres per year shown here for the decade.

The treatment opportunities described here are for the entire State. For land owners who would like to estimate the volume of timber on their land to help them make management decisions, an empirical yield table has been included in the Appendix. The table shows average growing-stock volumes per acre by stand-age class for average sites of each forest type. Owners can adjust these yields to reflect their estimate of the forest site quality of their land.

For many reasons, the treatments identified here may not be carried out. Wood production may not be a priority for some land owners. Social or political considerations may limit timber management. Traditional markets may not exist for some products removed during treatment. Physical features (i.e., physiographic class, slope, distance to transportation systems) may make some sites inoperable or uneconomical. Administrative regulations may limit treatment options in other areas.

For these reasons, the acreage targeted for treatment in this report is the biological maximum available given the treatment criteria and current North Dakota forest conditions. Forest managers and planners can temper the findings to fit resource conditions in their areas.

NONTIMBER FOREST RESOURCES

RPA mandates that forest inventories assess all renewable resource outputs from forest land. Timber is a relatively easy resource to assess, and most people agree on what timber data should be collected and presented. But agreement is not universal with other forest resources. Future forest inventories will need to address the problems of assessing nontimber forest resources. For the second North Dakota Forest Inventory, a general discussion of three nontimber forest resources (recreation, water, and wildlife) is presented here.

Outdoor Recreation[7]

North Dakota citizens enjoy a variety of recreational activities in which forests play a role. Forests may make recreational activities more enjoyable by influencing water quality, providing wildlife habitat, or enhancing the aesthetic value of an area (fig. 28).

Most of North Dakota's recreational facilities are owned and managed by the State. The North Dakota Forest Service manages five State Forests comprising over 12,900 acres. The State Forests are managed on a multiple-use basis to provide a continuous supply of forest products, wildlife habitat, forage, and recreational opportunities. In north-central North Dakota seven State Forest Recreation Areas provide facilities for camping, swimming, hiking, hunting, fishing, cross-country skiing, snowshoeing, and snowmobiling.

In 1965, the State legislature created the North Dakota State Outdoor Recreation Agency to plan and coordinate a State outdoor recreation plan. In the same year, the North Dakota Park Service was formed and charged with acquiring, preserving, and developing a system of parks in areas of scenic, historical, or recreational importance.

Currently, the North Dakota Park Service administers 14 park facilities (fig. 29). In 1980, nearly 1 million people visited North Dakota's State parks, an increase of 6 percent over that reported in 1979. The popularity of these facilities can be at least partially attributed to the forests on or near them. For example, the State's most popular park, Lake Metigoshe, is situated within the aspen forests of the Turtle Mountains. The area attracts visitors year around as it offers facilities for camping, swimming, fishing, hiking, cross-country skiing, snowshoeing, and snowmobiling. The park's Old Oak Trail was designated as the first National Recreation Trail in North Dakota.

In 1980 Fort Lincoln State Park was the second most popular park. Its modern campground and picnic area are located in a scenic forested area adjacent to the Heart and Missouri Rivers.

Several federal agencies manage areas for many recreational activities. The USDA Forest Service administers 1.1 million acres of national grasslands. These areas offer opportunities for dispersed recreation, especially hunting.

The National Park Service administers the Theodore Roosevelt National Park in western North Dakota. This park is known for its natural prairie, grasslands, and wildlife. Buffalo, deer, fox, and coyotes can often be seen from park roads around daybreak; journeys into the interior can give the visitor a chance to view wild horses and bighorn sheep. Although trees are scarce in the Great Plains, Rocky Mountain juniper in coulees and draws and hardwood stands along streambanks provide wildlife habitat and refreshing shade.

[7] *Background information and statistics supplied by John Van Ells, North Dakota Forest Service; Glenn Roloff, USDA Forest Service; and news releases and pamphlets from the North Dakota Park Service.*

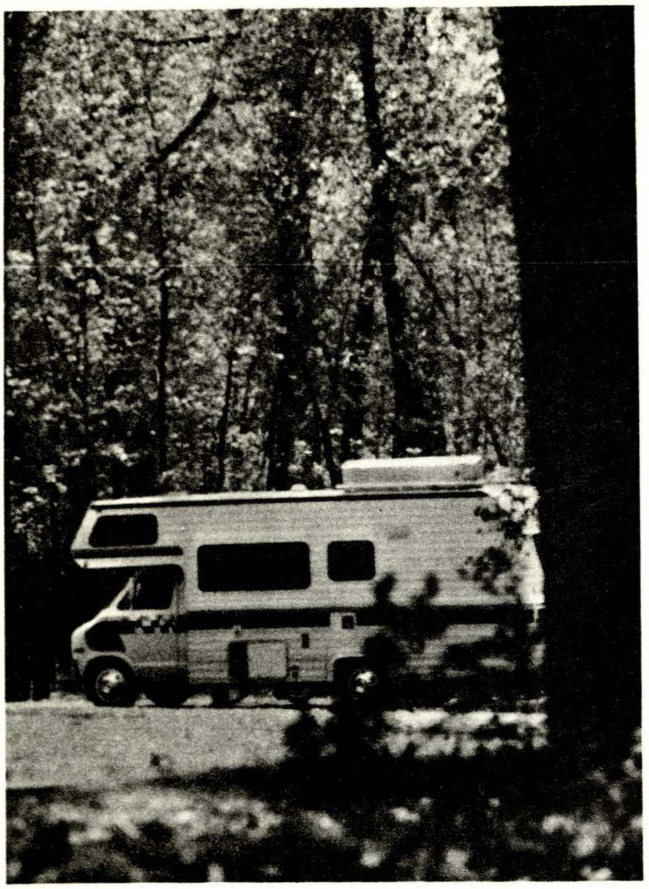

Figure 28. — *The forests of North Dakota offer opportunities for a wide range of recreational activities.*

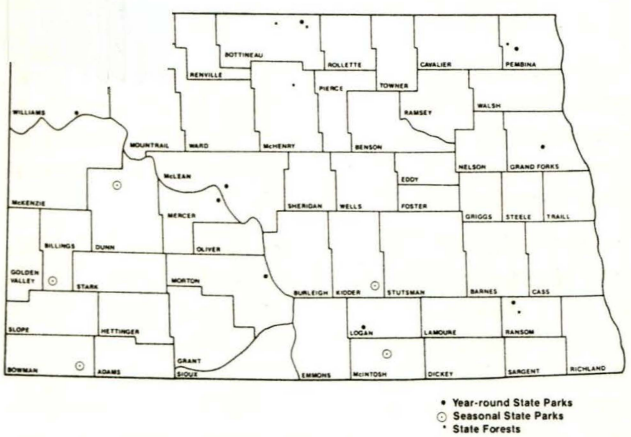

Figure 29. — *North Dakota's State Parks and State Forests.*

The U.S. Army Corps of Engineers administers many of North Dakota's reservoirs including Garrison, Homme, and Oahe Reservoirs, and Lake Ashtabula. These lakes and reservoirs provide many public recreational areas, some of which are managed by the Corps; others are leased to State, county, and local agencies. Lake Sakakawea State Park on the south shore of Lake Sakakawea (the lake formed by Garrison Dam) is the most popular State park for water-related recreation.

Water Resources[8]

In North Dakota, water resource problems and management opportunities center around water quality and the timing and distribution of precipitation. Forests can have an impact on these characteristics.

[8] *Information for this section came primarily from Mineral and Water Resources of North Dakota, North Dakota Geological Survey, Bulletin 63.*

The climate of North Dakota ranges from semiarid in the west to subhumid in the east. Rainfall is erratic. Occurring mostly between April and July, precipitation averages 13 inches in the western counties and 20 inches along the eastern border each year. An estimated three-fourths of North Dakota's precipitation reaches streams, but runoff is variable. Approximately 60 percent of North Dakota's land area drains into the Missouri River and its tributaries; the rest of the State drains into Hudson Bay through the Red and Souris Rivers. Runoff averages 2.5 billion gallons of water per day. There are also large ground water reserves in the State, but poor water quality and the high retrieval costs limit their use. Many of these reserves are overlain with fairly impermeable rock, limiting recharge.

Nearly one-third of North Dakota's commercial forest land is within 660 feet of water — a river, lake, or reservoir. In addition, most of the State's 167,000 acres of wooded strips occur along rivers and streams. The high infiltration capacity of these forested soils helps moderate runoff entering surface waters. Precipitation filtered through forest soils is relatively free of sediment, thereby improving or maintaining water quality. By shading streams, forests help lower water temperatures, which is important for the survival of many fish species, such as walleye. Finally, the thousands of miles of windbreaks and shelterbelts across North Dakota help distribute snow over areas where water from the spring melt can be most useful.

Wildlife Resources[9]

North Dakota's forests provide critical habitat for many popular wildlife species including the bald eagle, wild turkey, white-tailed deer, and ruffed grouse. A look at one wildlife game species, ruffed grouse, will demonstrate the importance of maintaining and managing the timber resource to provide wildlife habitat.

The success of a ruffed grouse population is closely related to the condition of aspen forests. To flourish, ruffed grouse populations require three age classes of aspen. Broods of ruffed grouse do best in aspen stands less than 10 years old. Young aspen trees less than 4 inches in diameter provide maximum protection from raptors, the primary predator of ruffed grouse. Stands of aspen between 10 and 20 years old are preferred cover for adult birds. The male flowers of aspen between 20 and 30 years old are a primary food source for these upland game birds.

In North Dakota, ruffed grouse populations have been flourishing in the Turtle Mountains and Pembina Hills, although preliminary surveys show they may be declining in 1981. The North Dakota Game and Fish Department is managing aspen stands in the Wakopa Wildlife Management Area (in Rollette County) to improve ruffed grouse habitat. The Department cleared 20 acres of aspen in 1980 in eight 2.5-acre plots. Winter clearcuts were used to increase aspen reproduction density and improve habitat for ruffed grouse broods. The clearing operations also provided additional browse for white-tailed deer (fig. 30). Ruffed grouse populations are also being monitored in the Killdeer Mountains, where birds were introduced between 1977 and 1979. The North Dakota Forest Service performs wildlife habitat improvement work on approximately 30 acres annually in the Turtle Mountains. Five- to 10-acre clearings are made to improve habitat primarily for ruffed grouse and white-tailed deer. Both the State Forest Service and the Game Department plan to continue managing aspen stands to maintain and improve critical habitat.

The North Dakota State Game and Fish Department manages 148 wildlife management areas in 47 of the State's 53 Counties. The areas total nearly 146,500 acres, 25,400 of which are woodland. The Department participates in two major programs to help maintain wildlife habitat in the State. The Water Bank Program, administered with the help of the U.S. Department of Agriculture, pays farmers to retire their wetlands and adjacent uplands from farming. In 1980 there were 244,260 acres of land in the Water Bank Program. The Interest Money Program maintains funds for developing fish and wildlife habitat on private lands.

The sales of hunting and fishing licenses in the State show that North Dakotans value their fish and wildlife resources and the activities of the Game and Fish Department. In 1979 more than 90,000 citizens spent nearly $1 million on hunting licenses. An additional 9,800 nonresidents enjoyed hunting in North Dakota. The State sold approximately 78,250 small game licenses, 37,900 deer gun licenses, and 8,100 deer bow licenses.

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[9]*Information for this section came primarily from the 1980 Annual Report, State Game and Fish Department. North Dakota Outdoors 43(7). January, 1981.*

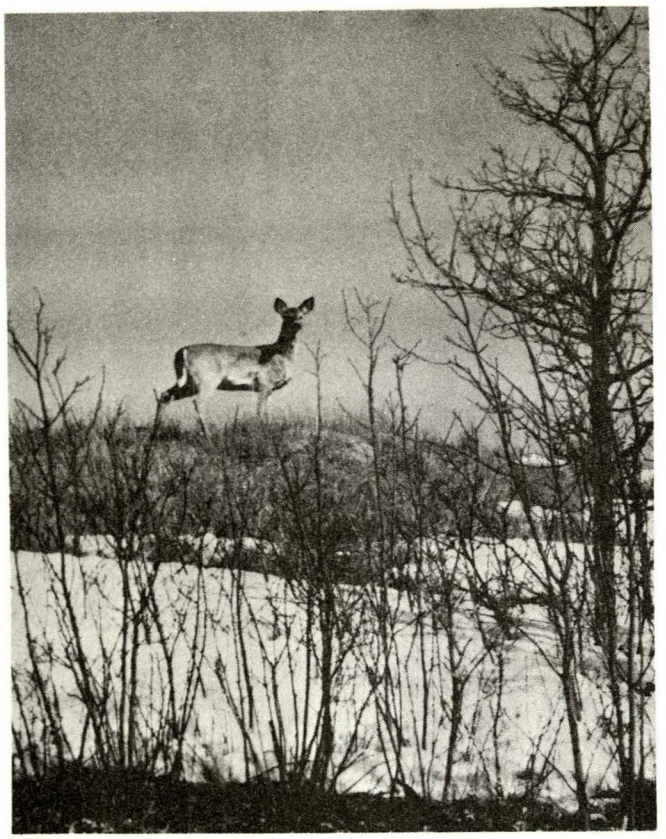

Figure 30. — *Management of the State's forest land can improve habitat for many popular wildlife species. (Photo courtesy of the North Dakota Forest Service.)*

APPENDIX

Accuracy of Survey

ırces Evaluation information is based on a ing procedure designed to provide reliable sta- ıtics at the State and Survey Unit levels. Consequently, the reported figures are estimates only. Sampling errors give a measure of reliability of these figures. These sampling errors mean that the chances are two out of three that if a 100-percent inventory had been taken using the same methods, the results would have been within the limits indicated.

For example, the estimated area of commercial forest land in North Dakota in 1980 (343,200 acres) has a sampling error of ± 6.42 percent (± 22,033 acres). The commercial forest area from a 100-percent inventory, then, would be expected to fall between 321,167 and 365,233 acres (343,200 ± 22,033), there being a one in three chance that this is not the case.

The following tabulation shows the sampling errors for the 1980 North Dakota Forest Inventory:

Item	North Dakota totals	Sampling error (Percent)
Growing stock	(Million cubic feet)	
Volume	207.1	7.96
Growth	7.7	8.65
Removals	1.5	27.23
Sawtimber	(Million board feet)[10]	
Volume	509.9	11.58
Growth	30.2	14.60
Removals	2.9	25.40
Commercial forest land	(Acres)	
	343,200	6.42

As survey data are broken down into sections smaller than State or Survey Unit totals, the sampling error increases. The smaller the breakdown, the larger the sampling error. For example, the sampling error for area of commercial forest land in a particular county is higher than that for total commercial forest area in the Survey Unit (table 65 shows the sampling errors for estimates smaller than State totals).

Survey Procedure

The major steps in determining the areas by land class and forest type were as follows:

1. A total of 226,893 1-acre points were distributed systematically across aerial photos of the entire State. These points were classified as either forest land (2,848), unproductive forest land (401), nonforest land (223,397), or questionable (247) to make a preliminary estimate of forest area. Next, all forest points and 1 out of 13 of the points on unproductive forest land, nonforest land with trees, and questionable land were stereoclassified as to forest type, stand-size class, and density. Then 219 points classed as forest, 31 points classed as unproductive, 19 points classed as questionable, and 17,183 points classified as nonforest were examined on the ground to correct the preliminary area estimate for errors in classification and for actual changes in land use since the photos were taken.

2. Data were compiled at the St. Paul office.

Method for Evaluating Treatment Opportunities

Treatment opportunities are projected for a decade because 10 years is viewed as a reasonable planning period, and because ideally, forest inventories are conducted on a 10-year basis. In practice, treatments would occur throughout the decade. An estimate of the average annual volumes removed during the treatment must reflect the growth that would occur on

[10] *International 1/4-inch log rule.*

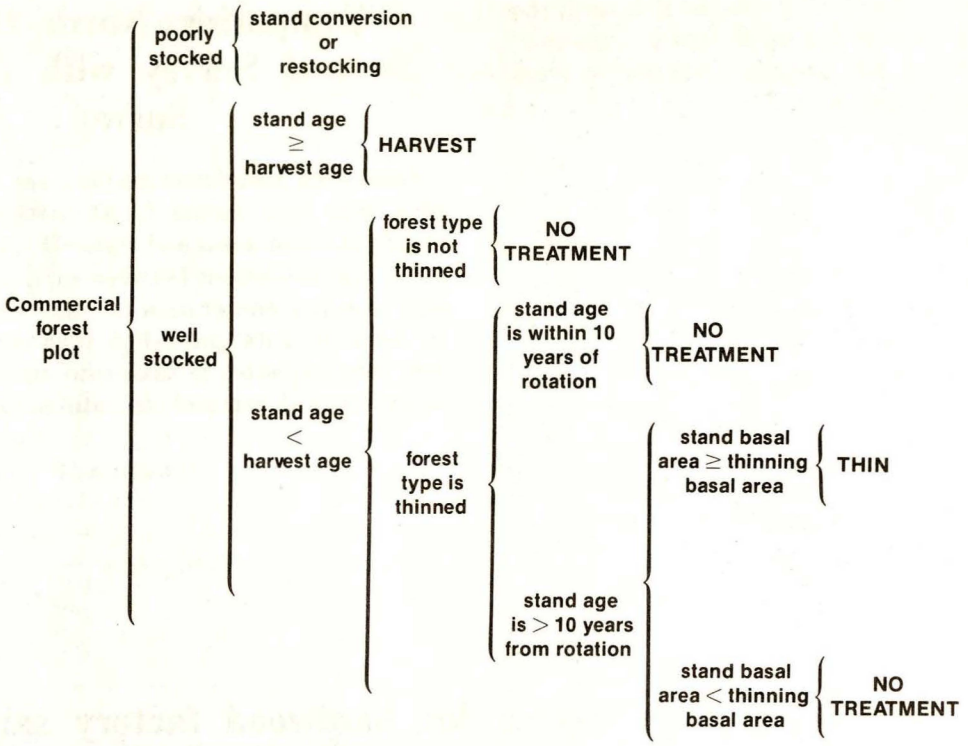

Figure 31. — *Logic used to assign treatments to commercial forest plots.*

plots between 1980 (when the data were collected) and the time of treatment. For this reason it was necessary to project each treated plot 5 years as an estimate of average growth for the decade before treatments were evaluated. To accomplish this, plot data from the 1980 North Dakota Forest Inventory were used as input to the Stand and Tree Evaluation and Modeling System (STEMS).[11] The System "grew" each plot for 5 years, calculating areas and volumes represented by the plots. After the projection, the following process was used to identify treatment opportunities (fig. 31).

(1) **Identify areas for stand conversion or restocking.** — The basal area for each plot was compared to the stand age to see if the plot would achieve full stocking. A plot was selected for stand conversion or restocking if plot basal area was $\leq 19 +$ (0.38 x stand age). Some plots at or past rotation age fell into this category. These plots were placed under the stand conversion or restocking treatment category rather than the harvest category because low stocking will probably necessitate extra regeneration efforts.

(2) **Identify areas for harvest.** — Criteria outlined in table 3 were used to calculate harvest acreage for each forest type for the decade 1980-1989. All plots at rotation age or above were selected for harvest. Harvest volume is the projected volume found on harvest plots.

(3) **Identify areas for thinning.** — Criteria outlined in table 3 were used to calculate thinning acreage for each forest type for the decade 1980-1989. Thinning was prescribed for all forest types except aspen. Stands selected for thinning must be at least 10 years from rotation age. In the oak forest type, thinning on high sites occurred only in stands less than 51 years old; thinning on low sites occurred only in stands less than 41 years old.

On plots selected for thinning, STEMS assigned the highest thinning priority to cull trees, then to growing-stock trees of undesirable species (elm, boxelder, and noncommercial species), and finally to growing-stock crop trees. Large diameter growing-stock crop trees were favored for retention during thinning oper-

[11] *U.S. Department of Agriculture, Forest Service. 1979. A generalized forest growth projection system applied to the Lake States region. U.S. Department of Agriculture Forest Service, General Technical Report NC-49, 96 p. U.S. Department of Agriculture Forest Service, North Central Forest Experiment Station, St. Paul, Minnesota.*

ations. Trees were "thinned" from the plot until the recommended post-thinning basal area was reached. Thinning volume is the projected volume of trees removed during thinning.

Comparing North Dakota Second Survey with the First Survey

Data from new forest surveys are often compared with data from earlier forest surveys to determine trends in forest areas and volumes. Changes in procedures and definitions between surveys make it necessary to adjust earlier data to make them comparable. In North Dakota, published 1954 commercial forest area was adjusted to take into account changes in survey procedures and definitions between surveys.

Forest Service standard grades for hardwood factory saw logs

Grading factors		Specifications							
		Log grade 1			Log grade 2				Log grade 3
Position in tree		Butts only	Butts and uppers		Butts and uppers				Butts and uppers
Scaling diameter, inches		13-15[1]	16-19	20+	11+[2]		12+	8+	
Length without trim, feet			10+		10+	8-9	10-11	12+	8+
Required	Min. length, feet	7	5	3	3	3	3	3	2
clear cuttings[3] of each of three best faces[4]	Max. number	2	2	2	2	2	2	3	No limit
	Min. proportion of log length required in clear cutting	5/6	5/6	5/6	2/3	3/4	2/3	2/3	1/2
Maximum sweep & crook ...ice	For logs with less than one-fourth of end in sound defects		15 percent				30 percent		50 percent
	For logs with more than one-fourth of end in sound defects		10 percent				20 percent		35 percent
... m scaling deduction			40 percent[5]				50 percent[6]		50 percent

[1]Ash and basswood butts can be 12 inches if they otherwise meet requirements for small #1's.
[2]Ten-inch logs of all species can be #2's if they otherwise meet requirements for small #1's.
[3]A clear cutting is a portion of a face, extending the width of the face, that is free of defects.
[4]A face is one-fourth of the surface of the log as divided lengthwise.
[5]Otherwise #1 logs with 41-60 percent deductions can be #2.
[6]Otherwise #2 logs with 51-60 percent deductions can be #3.

Forest Service standard specifications for hardwood construction logs (tie and timber logs)[1]

Position in tree		Butt and upper
Min. diameter, small end		8 inches+
Min. length, without trim		8 feet
Clear cuttings		No requirements.
Sweep allowance, absolute		One-fourth of the diameter of the small end for each 8 feet of length.
Sound surface defects	Single knots	Any number,if no one knot has an average diameter above the callus in excess of one-third of log diameter at point of occurrence.
	Whorled knots	Any number if sum of knot diameters above the callus does not exceed one-third of log diameter at point of occurrence.
	Holes	Any number, provided none has a diameter over one-third of log diameter at point of occurrence, and none extends over 3 inches into included timber.[2]
Unsound surface defects		Same requirements as for sound defects if they extend into included timber.[2] No limit if they do not.
End defects	Sound	No requirements.
	Unsound	None allowed; log must be sound internally, but will admit one shake not to exceed one-fourth of the scaling diameter and will admit a longitudinal split not extending more than 5 inches into the contained timber.

[1]These specifications are minimum for the class. If, from a group of logs, factory logs are selected first, thus leaving only nonfactory logs from which to select construction logs, then the quality range of the construction logs selected is limited, and the class may be considered a grade. If selection for construction logs is given first priority, then it may be necessary to subdivide the class into grades.

[2]Included timber is always square, and dimension is judged from small end.

Log Grades for Ponderosa Pine

Grade 1 — logs with three or four clear faces.[12]

Grade 2 — logs with one or two clear faces.

Grade 3 — logs with no clear faces.

After the tentative log grade is established, the log will be degraded one grade for sweep or heart rot. No log can be degraded below grade 3. Net scale after deduction for defect must be at least 50 percent of the gross contents of the log.

[12]*A face is one-fourth of the circumference in width extending full length of the log. Clear faces are those free of knots measuring more than 1/2 inch in diameter, overgrown knots of any size, or holes more than 1/4 inch in diameter. Faces may be rotated to obtain the maximum number of clear ones.*

1. **Sweep.** — Degrade any tentative 1 or 2 log one grade if sweep amounts to 3 or more inches and equals or exceeds one-third the diameter inside bark at small end.

2. **Heart rot.** — Degrade any tentative 1 or 2 log grade if conk, massed hyphae, or other evidence of advance heart rot is found.

Metric Equivalents of Units Used in this Report

1 acre = 4,046.86 square meters or 0.405 hectare.
1,000 acres = 405 hectares.
1,000 board feet (International 1/4-inch log rule) = 3.48 cubic meters.
Breast height = 1.4 meters above the ground.
1 cubic foot = 0.0283 cubic meter.
1 foot = 30.48 centimeters or 0.3048 meter.
1 inch = 25.4 millimeters, 2.54 centimeters, or 0.0254 meter.

Definition of Terms

Acceptable trees. — Growing-stock trees of commercial species that meet specified standards of size and quality but do not qualify as desirable trees.

Area-Condition Classes. — Class 10. — Areas fully stocked with desirable trees but not overstocked.

Class 20. — Areas fully stocked with desirable trees but overstocked with all live trees.

Class 30. — Areas medium to fully stocked with desirable trees and with less than 30 percent of the area controlled by other trees and/or inhibiting vegetation or surface conditions that will prevent occupancy by desirable trees.

Class 40. — Areas medium to fully stocked with desirable trees and with 30 percent or more of the area controlled by other trees and/or conditions that ordinarily prevent occupancy by desirable trees.

Class 50. — Areas poorly stocked with desirable trees but fully stocked with growing-stock trees.

Class 60. — Areas poorly stocked with desirable trees but with medium to full stocking of growing-stock trees.

Class 70. — Areas poorly stocked with desirable trees and poorly stocked with growing-stock trees.

Basal area. — The area in square feet of the cross section at breast height of a single tree. When the basal area of all trees in a stand are summed, the result is usually expressed as square feet of basal area per acre.

Commercial forest land. — Forest land producing or capable of producing crops of industrial wood and not withdrawn from timber utilization. (Note: Areas qualifying as commercial forest land have the capability of producing in excess of 20 cubic feet per acre per year of industrial wood under management. Currently inaccessible and inoperable areas are included, except when the areas involved are small and unlikely to become suitable for production of industrial wood in the foreseeable future.)

Commercial species. — Tree species presently or prospectively suitable for industrial wood products. (Note: Excludes species of typically small size, poor form, or inferior quality such as hawthorn and sumac).

County and municipal land. — Land owned by counties and local public agencies or municipalities, or land leased to these governmental units for 50 years or more.

Cull. — Portions of a tree that are unusable for industrial wood products because of rot, form, or other defect.

Desirable trees. — Growing-stock trees of relatively high vigor having no serious defects limiting present or prospective use, and containing no pathogens that may result in death or serious deterioration before rotation age. These are trees that would be favored by forest managers in silvicultural operations.

Diameter class. — A classification of trees based on diameter outside bark, measured at breast height (4-1/2 feet above the ground). (Note: D.b.h. is the common abbreviation for diameter at breast height. Two-inch diameter classes are commonly used in Forest Survey, with the even inch the approximate midpoint for a class. For example, the 6-inch class includes trees 5.0 through 6.9 inches d.b.h. inclusive.)

Farm. — Either a place operated as a unit of 10 or more acres from which the sale of agricultural products totals $50 or more annually, or a place operated as a unit of less than 10 acres from which the sale of agricultural products for a year amounts to at least $250. Places having less than the $50 or $250 minimum estimated sales in a given year are also counted as farms if they can normally be expected to produce goods in sufficient quantity to meet the requirements of the definition.

Farmer-owned land. — Land owned by farm operators. (Note: Excludes land leased by farm operators from nonfarm owners, such as railroad companies and States.)

Forest land. — Land at least 16.7 percent stocked by forest trees of any size, or formerly having had such tree cover, and not currently developed for nonforest use. (Note: Stocking is measured by comparison of basal area and/or number of trees, by age or size and spacing with specified standards. The minimum area for classification of forest land is 1 acre. Roadside, streamside, and shelterbelt strips of timber must have a crown width of at least 120 feet to qualify as forest land. Unimproved roads and trails, streams, or other bodies of water or clearings in forest areas shall be classed as forest if less than 120 feet wide.) Also see definitions for land area, commercial forest land, noncommercial forest land, productive-reserved forest land, stocking, unproductive forest land, and water.

Forest trees. — Woody plants having a well-developed stem and usually more than 12 feet in height at maturity.

Forest type. — A classification of forest land based upon the species forming a plurality of live tree stocking.

Ponderosa pine. — Forests in which ponderosa pine comprises a plurality of the stocking. In North Dakota ponderosa pine occurs in pure stands.

Oak. — Forests in which bur oak comprises a plurality of the stocking. (Common associates include ash, basswood, and elm.)

Elm-ash. — Forests in which lowland elm and ash, singly or in combination, comprise a plurality of the stocking. (Common associates include cottonwood and bur oak.)

Cottonwood. — Forests in which cottonwood comprises a plurality of the stocking. (Common associates include boxelder and elm.)

Plains hardwood. — Forests in which basswood comprises a plurality of the stocking. (Common associates include elm and oak.)

Aspen-birch. — Forests in which quaking aspen, paper birch, and river birch, singly or in combination, comprise a plurality of the stocking. (Common associates include balsam poplar, ash, and oak.)

Growing-stock trees. — Live trees of commercial species qualifying as acceptable trees. (Note: Excludes rough, rotten, and dead trees.)

Growing-stock volume. — Net volume in cubic feet of growing-stock trees 5.0 inches d.b.h. and over from a 1-foot stump to a minimum 4.0-inch top diameter outside bark (t.d.o.b.) of the central stem or to the point where the central stem no longer meets pulpwood specifications.

Hardwoods. — Dicotyledonous trees, usually broad-leaved and deciduous.

Idle farmland. — Includes former croplands, orchards, improved pastures, and farm sites not tended within the past 2 years and presently less than 16.7 percent stocked with trees.

Improved pasture. — Land currently improved for grazing by cultivation, seeding, irrigation, or clearing of trees or brush and less than 16.7 percent stocked with live trees.

Indian land. — Tribal land held in fee but administered by the Federal Government.

Land area. — A. Bureau of the Census. The area of dry land and land temporarily or partly covered by water, such as marshes, swamps, and river flood plains (omitting tidal flats below mean high tide); streams, sloughs, estuaries, and canals less than one-eighth of a statute mile wide; and lakes, reservoirs, and ponds less than 40 acres in area.

B. Forest Survey. The same as the Bureau of Census, except minimum width of streams, etc. is 120 feet and minimum size of lakes, etc., is 1 acre.

Live trees. — Growing-stock, rough and rotten trees 1 inch d.b.h. and larger.

Log grade. — A classification of logs based on external characteristics as indicators of quality or value.

Logging residues. — The unused growing-stock portions of trees cut or killed by logging.

Maintained road. — Any road, hard topped or other surfaces, that is plowed or graded at least once a year. Includes rights-of-way that are cut or treated to limit herbaceous growth.

Marsh. — Nonforest land that characteristically supports low, generally herbaceous or shrubby vegetation and that is intermittently covered with water.

Merchantable. — Refers to a pulpwood or saw lc section that meets pulpwood or saw log specific: tions, respectively.

Miscellaneous Federal land. — Federal land other than National Forest, land administered by the Bureau of Land Management, and Indian land.

Miscellaneous private land. — Privately owned land other than forest-industry and farmer-owned land.

Mortality. — Standing or down dead trees that have died within the last 3 years.

National Forest land. — Federal land that has been legally designated as National Forest or purchase units, and other land under the administration of the Forest Service.

Net annual growth of growing stock. — The annual change in volume of sound wood in live sawtimber and poletimber trees and the total volume of trees entering these classes through ingrowth, less volume losses resulting from natural causes.

Net annual growth of sawtimber. — The annual change in the volume of live sawtimber trees and the total volume of trees reaching sawtimber size, less volume losses resulting from natural causes.

Net volume. — Gross volume less deductions for rot, sweep, or other defect affecting use for timber products.

Noncommercial forest land. — (a) Unproductive forest land and (b) productive-reserved forest land.

Noncommercial species. — Tree species of typically small size, poor form,or inferior quality which normally do not develop into trees suitable for industrial wood products.

Nonforest land. — Land that has never supported forests and land formerly forested where use for timber management is precluded by development for other uses. (Note: Includes areas used for crops, improved pasture, residential areas, city parks, improved roads of any width and adjoining clearings, powerline clearings of any width, and 1- to 40-acre areas of water classified by the Bureau of the Census as land. If intermingled in forest areas, unimproved roads and nonforest strips must be more than 120 feet wide and more than 1 acre in area, to qualify as nonforest land.)

a. *Nonforest land with trees.* — Nonforest land with no live trees present.

b. *Nonforest land without trees.* — Nonforest land with one or more trees at least 5 inches in d.b.h. per acre.

Nonstocked land. — Commercial forest land less than 16.7 percent stocked with growing-stock trees.

Ownership. — Property owned by one owner, regardless of the number of parcels in a specified area.

Ownership size class. — The amount of commercial forest land owned by one owner, regardless of the number of parcels.

Poletimber stands. — (See stand-size class.)

Poletimber trees. — Growing-stock trees of commercial species at least 5.0 inches d.b.h. but smaller than sawtimber size.

Productive-reserved forest land. — Forest land sufficiently productive to qualify as commercial forest land but withdrawn from timber utilization through statute, administration, designation, or exclusive use for Christmas tree production as indicated by annual shearing.

Prospectively. — As used in this manual it refers to the moment a tree will reach sawtimber size at d.b.h.

Rangeland. — Land on which the natural plant cover is composed principally of native grasses, forbs, or shrubs valuable for forage.

Reserved areas. — Nonforest land with trees administered as State Parks, National Parks, or National Grasslands.

Rotten trees. — Live trees of commercial species that do not contain at least one 12-foot saw log or two saw logs 8 feet or longer, now or prospectively, and/or do not meet Regional specifications for freedom from defect primarily because of rot; that is, when more than 50 percent of the cull volume in a tree is rotten.

Rough trees. — (a) Live trees of commercial species that do not contain at least one 12-foot saw log or two saw logs 8 feet or longer, now or prospectively, and/or do not meet Regional specifications for freedom from defect primarily because of roughness or poor form, and (b) all live trees of noncommercial species.

Roundwood products. — Logs, bolts, or other round sections cut from trees for industrial or consumer uses. (Note: Includes saw logs, veneer logs, and bolts; cooperage logs and bolts; pulpwood; fuelwood; piling; poles; posts; hewn ties; mine timbers; and various other round, split, or hewn products.)

Salvable dead trees. — Standing or down dead trees that are considered merchantable by Regional standards.

Saplings. — Live trees 1.0 inch to 5.0 inches d.b.h.

Sapling-seedling stands. — (See stand-size class.)

Saw log. — A log meeting minimum standards of diameter, length, and defect, including logs at least 8 feet long, sound and straight, and with a minimum diameter outside bark (d.o.b.) for softwoods of 7 inches (9 inches for hardwoods) or other combinations of size and defect specified by Regional standards.

Saw log portion. — That part of the bole of sawtimber trees between the stump and the saw log top at 9.0 d.o.b. for hardwoods and 7.0 d.o.b. for softwoods whenever they are present. (Does not refer to sections meeting minimum log grade specifications.)

Saw log top. — The point on the bole of sawtimber trees above which a saw log cannot be produced. The minimum saw log top is 7.0 inches d.o.b. for softwoods and 9.0 inches d.o.b. for hardwoods.

Sawtimber stands. — (See stand-size class.)

Sawtimber trees. — Live trees of commercial species containing at least a 12-foot saw log or two saw logs 8 feet or longer and meeting Regional specifications for freedom from defect. Softwoods must be at least 9.0 inches d.b.h. Hardwoods must be at least 11.0 inches in diameter.

Sawtimber volume. — Net volume of the saw log portion of live sawtimber in board feet (International 1/4-inch rule).

Seedlings. — Live trees less than 1.0 inch d.b.h. that are expected to survive.

Shelterbelt. — Planted stands of trees either less than 120 feet wide or smaller than 1 acre or both.

Short-log (rough tree). — Sawtimber-size trees of commercial species that contain at least one merchantable 8- to 11-foot saw log but not a 12-foot saw log.

Shrub biomass. — The total above-ground volume (including the bark) of selected shrubs and trees less than 1 inch d.b.h.

Site class. — A classification of forest land in terms of inherent capacity to grow crops of industrial wood based on fully stocked natural stands.

Site index. — An expression of forest site quality based on the height of a free-growing dominant or codominant tree of a representative species in the forest type at age 50.

Softwoods. — Coniferous trees, usually evergreen, having needles or scale-like leaves.

Stand. — A growth of trees on a minimum of 1 acre of forest land that is stocked by forest trees of any size.

Stand-age class. — Age of the main stand. Main stand refers to trees of the dominant forest type and stand-size class.

Stand-area class. — The extent of a continuous forested area of the same forest type, stand-size class, and stand-density class.

Stand-size class. — A classification of forest land based on the size class of growing-stock trees on the area; that is, sawtimber, poletimber, or seedlings and saplings. (Note: Only those trees that contribute to no more than 16 percent stocking at a plot point will be considered in determining stand-size class.)

a. *Sawtimber stands.* — Stands at least 16.7 percent stocked with growing-stock trees, with half or more of total stocking in sawtimber or poletimber trees, and with sawtimber stocking at least equal to poletimber stocking.

b. *Poletimber stands.* — Stands at least 16.7 percent stocked with growing-stock trees of which half or more of this stocking is in poletimber and/or sawtimber trees, and with poletimber stocking exceeding that of sawtimber.

c. *Sapling-seedling stands.* — Stands at least 16.7 percent stocked with growing-stock trees of which more than half of the stocking is saplings and/or seedlings.

d. *Nonstocked stands.* — Stands in which stocking of growing-stock trees is less than 16.7 percent.

Stand-volume class. — The amount of sawtimber (in board feet) per acre of commercial forest land.

State land. — Land owned by States, or land leased to these governmental units for 50 years or more.

Stocking. — The degree of occupancy of land by trees, measured by basal area and/or the number of trees in a stand by size or age and spacing, compared to the basal area and/or number of trees required to fully utilize the growth potential of the land; that is, the stocking standard. (Note: Also see stocking explanation in section 21.5 of Forest Survey Handbook.)

Timber removals from growing stock. — The volume of sound wood in growing-stock trees removed annually for forest products (including roundwood products and logging residues) and for other removals.

Timber removals from sawtimber. — The net board-foot volume of live trees removed for forest products annually (including roundwood products and logging residues) and for other removals.

Timber products output. — All timber products cut from roundwood and byproducts of wood manufacturing plants. Roundwood products include logs, bolts, or other round sections cut from growing-stock trees and cull trees.

Tree biomass. — The total aboveground volume (including the bark) of all trees 1 to 5 inches d.b.h. and the total aboveground volume (including the bark) from a 1-foot stump for trees more than 5 inches in diameter.

Tree size class. — A classification of trees based on diameter at breast height, including sawtimber trees, poletimber trees, saplings, and seedlings.

Unproductive forest land. — Forest land incapable of producing 20 cubic feet per acre of industrial wood because of adverse site conditions. (Note: Adverse conditions include sterile soils, dry climate, poor drainage, high elevation steepness, and rockiness.)

Unproductive-reserved forest land. — Unproductive forest land withdrawn from timber utilization through statute, administration, or designation.

Upper stem portion. — That part of the bole of a sawtimber tree above the saw log top to a minimum top diameter of 4.0 inches outside bark or to the point where the central stem breaks into limbs.

Urban and other areas. — Areas within the legal boundaries of cities and towns; suburban areas developed for residential, industrial, or recreational purposes; schoolyards, cemeteries, roads; railroads; airports; beaches; powerlines; other rights-of-way; or other nonforest land not included in any other specified land use class.

Water. — (a) *Bureau of the Census.* — Streams, sloughs, estuaries, and canals more than one-eighth of a statute mile wide; lakes, reservoirs, and ponds more than 40 acres in area.

(b) *Noncensus.* — The same as the Bureau of the Census, except minimum width of streams, etc., is 120 feet and minimum size of lakes, etc., is 1 acre.

Windbreak. — Planted or natural stand of trees more than 120 feet wide or larger than 1 acre used for the protection of buildings.

Wooded pasture. — Improved pasture with more than 16.7 percent stocking in all trees but less than 25 percent stocking in growing-stock trees. Area currently improved for grazing or shows other evidence of grazing.

Wooded strip. — An acre or more of natural continuous forest land that would otherwise meet survey standards for commercial forest land except that it is less than 120 feet wide.

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Table 6.--Area by land class and Forest Survey Unit, North Dakota, 1980

(In thousand acres)

Land class	All units	East Unit	West Unit
FOREST LAND			
Commercial	343.2	283.7	59.5
Unproductive	148.0	49.2	98.8
Productive-reserved	4.5	1.5	3.0
Unproductive-reserved	22.4	0.4	22.0
Total	518.1	334.8	183.3
NONFOREST LAND			
Nonforest with trees			
Reserved areas	78.0	1.3	76.7
Cropland	44.6	34.7	9.9
Improved pasture[1/]	436.6	44.6	392.0
Wooded strips[2/]	167.0	47.0	120.0
Idle farmland	9.8	4.9	4.9
Marsh	14.0	2.5	11.5
Windbreaks[3/]	30.1	23.4	6.7
Shelterbelts[4/]	187.3	135.8	51.5
Wooded pasture[1/]	18.3	13.8	4.5
Subtotal	985.7	308.0	677.7
Nonforest without trees			
Cropland	30,545.8	18,065.4	12,480.4
Improved pasture[1/]	10,121.1	2,259.9	7,861.2
Idle farmland	14.9	5.0	9.9
Marsh	968.9	637.0	331.9
Other farm-farmstead	215.4	94.1	121.3
Urban and other	889.5	466.6	422.9
Noncensus water	79.9	37.5	42.4
Subtotal	42,835.5	21,565.5	21,270.0
Total	43,821.2	21,873.5	21,947.7
TOTAL LAND	[5/]44,339.3	22,208.3	22,131.0
WATER (BUREAU OF THE CENSUS)	[5/]895.8	280.1	615.7
TOTAL LAND AND WATER	45,235.1	22,488.4	22,746.7

[1/] Includes areas classified as range by the USDA Soil Conservation Service.

[2/] An acre or more of natural continuous forest land less than 120 feet wide that would otherwise meet survey standards.

[3/] Planted or natural stand of trees more than 120 feet wide or larger than 1 acre used for protecting buildings.

[4/] Planted stands of trees less than 120 feet wide or smaller than 1 acre or both.

[5/] U.S. Department of Commerce, Bureau of the Census. 1970. Area Measurement reports, GE 20, No. 1, 22 p.

Table 7.--Area of land and forest land by county, North Dakota, 1980

EAST UNIT

County	Land area[1/]	Forest land			Percent commercial forest
		All forest	Non-commercial	Commercial	
	- - - - - - - - -Thousand acres- - - - - - - - - -				
Barnes	946.6	6.5	1.9	4.6	0.5
Benson	897.7	31.4	3.4	28.0	3.1
Bottineau	1,073.4	44.3	2.3	42.0	3.9
Cass	1,119.3	11.4	2.9	8.5	0.8
Cavalier	967.5	40.2	6.3	33.9	3.5
Dickey	731.6	1.2	0.4	0.8	0.1
Eddy	406.4	3.7	0.9	2.8	0.7
Foster	413.0	0.2	0.1	0.1	--
Grand Forks	920.3	11.0	2.6	8.4	0.9
Griggs	454.3	3.4	0.8	2.6	0.6
Kidder	868.9	--	--	--	--
LaMoure	727.0	1.3	0.4	0.9	0.1
Logan	640.3	0.2	0.1	0.1	--
McHenry	1,202.8	14.3	2.9	11.4	0.9
McIntosh	634.7	0.4	0.2	0.2	--
Nelson	636.9	5.2	1.3	3.9	0.6
Pembina	719.4	31.0	5.7	25.3	3.5
Pierce	664.3	2.1	0.6	1.5	0.2
Ramsey	799.0	2.8	0.4	2.4	0.3
Ransom	551.1	15.9	4.0	11.9	2.2
Richland	927.4	9.0	1.6	7.4	0.8
Rolette	584.0	64.1	4.1	60.0	10.3
Sargent	545.9	1.3	0.5	0.8	0.1
Steele	454.5	3.6	1.1	2.5	0.6
Stutsman	1,449.2	2.8	0.9	1.9	0.1
Towner	667.5	0.1	--	0.1	--
Traill	551.0	8.4	2.4	6.0	1.1
Walsh	823.0	17.6	2.8	14.8	1.8
Wells	831.3	1.4	0.5	0.9	0.1
All counties	22,208.3	334.8	51.1	283.7	1.3

(Table 7 continued on next page)

(Table 7 continued)

WEST UNIT

County	Land area[1/]	Forest land			Percent commercial forest
		All forest	Non-commercial	Commercial	
	- - - - - - - -Thousand acres- - - - - - - - - -				
Adams	633.1	0.1	0.1	--	--
Billings	729.0	17.2	13.7	3.5	0.5
Bowman	748.7	0.5	0.3	0.2	--
Burke	716.0	0.7	0.2	0.5	0.1
Burleigh	1,040.2	7.8	2.7	5.1	0.5
Divide	831.8	0.3	0.1	0.2	--
Dunn	1,275.0	37.9	26.4	11.5	0.9
Emmons	962.0	5.1	2.2	2.9	0.3
Golden Valley	649.0	2.4	1.1	1.3	0.2
Grant	1,066.1	2.9	1.9	1.0	0.1
Hettinger	726.0	0.4	0.2	0.2	--
McKenzie	1,750.4	55.1	50.4	4.7	0.3
McLean	1,321.6	7.4	2.6	4.8	0.4
Mercer	666.6	3.0	1.4	1.6	0.2
Morton	1,228.9	6.1	3.2	2.9	0.2
Mountrail	1,164.2	8.7	2.9	5.8	0.5
Oliver	461.3	3.7	2.3	1.4	0.3
Renville	567.2	0.9	0.4	0.5	0.1
Slope	783.8	7.5	5.0	2.5	0.3
Sheridan	632.7	0.4	0.2	0.2	--
Sioux	704.8	2.2	0.6	1.6	0.2
Stark	842.3	4.2	1.4	2.8	0.3
Ward	1,308.2	5.4	2.0	3.4	0.3
Williams	1,321.1	3.4	2.5	0.9	0.1
All counties	22,131.0	183.3	123.8	59.5	0.3
All units	44,339.3	518.1	174.9	343.2	0.8

[1/] U.S. Department of Commerce, Bureau of the Census. 1970. Area measurement reports, GE-20, No. 1, 22 p.

Table 8.--Area of commercial forest land by ownership class and Forest Survey Unit, North Dakota, 1980

(In thousand acres)

Ownership class	All units	East Unit	West Unit
National Forest	4.7	2.3	2.4
Miscellaneous federal	11.6	7.1	4.5
Indian	33.5	33.5	--
State	21.5	21.5	--
County and municipal	1.7	1.7	--
Farmer	261.6	212.4	49.2
Miscellaneous private	8.6	5.2	3.4
All owners	343.2	283.7	59.5

Table 9.--Area of commercial forest land by ownership class and forest type, North Dakota, 1980

(In thousand acres)

Ownership class	All types	Forest type						
		Ponderosa pine	Oak	Elm-ash	Cottonwood	Plains hardwoods	Aspen	Non-stocked
National Forest	4.7	--	2.3	--	2.4	--	--	--
Miscellaneous federal	11.6	--	--	4.5	--	--	7.1	--
Indian	33.5	--	5.0	5.0	--	2.3	17.8	3.4
State	21.5	--	--	--	--	--	21.5	--
County and municipal	1.7	--	1.7	--	--	--	--	--
Farmer	261.6	2.1	34.1	100.8	14.6	13.5	90.7	5.8
Miscellaneous private	8.6	--	1.1	3.4	1.7	--	2.4	--
All owners	343.2	2.1	44.2	113.7	18.7	15.8	139.5	9.2

Table 10.--Area of commercial forest land by ownership class and site class, North Dakota, 1980

(In thousand acres)

Ownership class	All classes	Site class (cubic feet of growth/acre/year)			
		119+	85-119	50-84	20-49
National Forest	4.7	--	--	--	4.7
Miscellaneous federal	11.6	--	--	--	11.6
Indian	33.5	--	--	10.2	23.3
State	21.5	--	--	21.5	--
County and municipal	1.7	--	--	--	1.7
Farmer	261.6	--	15.7	78.5	167.4
Miscellaneous private	8.6	--	--	2.5	6.1
All owners	343.2	--	15.7	112.7	214.8

Table 11.--Area of commercial forest land by ownership class and ownership size class, North Dakota, 1980

(In thousand acres)

Ownership class	Total	Ownership size class (acres)								
		1-5	5-10	10-20	20-50	50-100	100-500	500-2,500	2,500-5,000	5,000+
National Forest	4.7	--	--	--	--	--	--	--	4.7	--
Miscellaneous federal	11.6	--	--	--	--	--	--	--	--	11.6
Indian	33.5	--	--	--	--	--	--	--	--	33.5
State	21.5	--	--	--	--	--	--	--	--	21.5
County and municipal	1.7	--	--	--	--	--	--	1.7	--	--
Farmer	261.6	104.9	16.6	30.2	26.7	22.3	57.5	3.4	--	--
Miscellaneous private	8.6	4.1	--	1.7	1.7	--	1.1	--	--	--
All owners	343.2	109.0	16.6	31.9	28.4	22.3	58.6	5.1	4.7	66.6

Table 12.--Area of commercial forest land by ownership class, stand-size class, and Forest Survey Unit, North Dakota, 1980

(In thousand acres)

Ownership class	All stands	Stand-size class			
		Sawtimber stands	Poletimber stands	Sapling and seedling stands	Nonstocked areas
ALL UNITS					
National Forest	4.7	--	--	4.7	--
Miscellaneous federal	11.6	--	4.0	7.6	--
Indian	33.5	--	22.5	7.6	3.4
State	21.5	2.6	11.5	7.4	--
County and municipal	1.7	--	1.7	--	--
Farmer	261.6	89.9	106.5	59.4	5.8
Miscellaneous private	8.6	5.0	3.6	--	--
All owners	343.2	97.5	149.8	86.7	9.2
EAST UNIT					
National Forest	2.3	--	--	2.3	--
Miscellaneous federal	7.1	--	2.5	4.6	--
Indian	33.5	--	22.5	7.6	3.4
State	21.5	2.6	11.5	7.4	--
County and municipal	1.7	--	1.7	--	--
Farmer	212.4	77.8	91.5	42.0	1.1
Miscellaneous private	5.2	1.6	3.6	--	--
All owners	283.7	82.0	133.3	63.9	4.5
WEST UNIT					
National Forest	2.4	--	--	2.4	--
Miscellaneous federal	4.5	--	1.5	3.0	--
Indian	--	--	--	--	--
State	--	--	--	--	--
County and municipal	--	--	--	--	--
Farmer	49.2	12.1	15.0	17.4	4.7
Miscellaneous private	3.4	3.4	--	--	--
All owners	59.5	15.5	16.5	22.8	4.7

Table 13.--Area of commercial forest land by ownership class and area-condition class, North Dakota, 1980

(In thousand acres)

Ownership class	All classes	Area-condition class			
		70	60	50	40 or better
National Forest	4.7	2.4	2.3	--	--
Miscellaneous federal	11.6	6.3	2.3	3.0	--
Indian	33.5	20.7	12.8	--	--
State	21.5	5.1	13.8	2.6	--
County and municipal	1.7	--	1.7	--	--
Farmer	261.6	128.2	104.0	29.4	--
Miscellaneous private	8.6	8.6	--	--	--
All owners	343.2	171.3	136.9	35.0	--

Table 14.--Area of commercial forest land by ownership class and stand-volume class, North Dakota, 1980

(In thousand acres)

Ownership class	All classes	Stand-volume class (board feet[1] per acre)		
		Less than 1,500	1,500 to 5,000	5,000+
National Forest	4.7	4.7	--	--
Miscellaneous federal	11.6	8.6	3.0	--
Indian	33.5	33.5	--	--
State	21.5	12.5	9.0	--
County and municipal	1.7	--	1.7	--
Farmer	261.6	164.6	80.0	17.0
Miscellaneous private	8.6	5.2	3.4	--
All owners	343.2	229.1	97.1	17.0

[1]/International 1/4-inch rule.

Table 15.--Area of commercial forest land by county and forest type, North Dakota, 1980

(In thousand acres)

EAST UNIT

County	All types	Forest type						
		Ponderosa pine	Oak	Elm-ash	Cottonwood	Plains hardwoods	Aspen	Non-stocked
Barnes	4.6	--	0.2	2.8	0.2	0.6	0.8	--
Benson	28.0	--	6.3	4.6	--	1.1	14.9	1.1
Bottineau	42.0	--	2.9	4.2	--	0.5	34.0	0.4
Cass	8.5	--	0.8	5.2	0.2	1.0	1.3	--
Cavalier	33.9	--	2.8	13.6	0.3	2.1	15.1	--
Dickey	0.8	--	0.1	0.5	--	0.1	0.1	--
Eddy	2.8	--	0.6	1.3	--	0.2	0.6	0.1
Foster	0.2	--	--	0.2	--	--	--	--
Grand Forks	8.3	--	1.1	4.9	0.1	0.8	1.4	--
Griggs	2.6	--	0.3	1.6	--	0.3	0.4	--
Kidder	--	--	--	--	--	--	--	--
LaMoure	0.9	--	0.1	0.6	--	0.1	0.1	--
Logan	0.1	--	--	0.1	--	--	--	--
McHenry	11.3	--	1.9	6.5	0.2	1.1	1.5	0.1
McIntosh	0.2	--	--	0.2	--	--	--	--
Nelson	3.9	--	0.5	2.5	0.1	0.4	0.4	--
Pembina	25.4	--	7.4	6.4	0.2	2.1	7.9	1.4
Pierce	1.6	--	0.2	1.0	--	0.2	0.2	--
Ramsey	2.4	--	0.4	0.8	--	0.1	1.0	0.1
Ransom	11.8	--	3.4	5.8	0.2	1.0	1.4	--
Richland	7.4	--	1.1	4.7	0.1	0.6	0.9	--
Rolette	59.9	--	5.7	6.2	--	0.8	46.1	1.1
Sargent	0.9	--	--	0.5	--	0.1	0.3	--
Steele	2.6	--	0.1	1.6	0.2	0.3	0.4	--
Stutsman	1.9	--	0.1	1.1	0.1	0.3	0.3	--
Towner	0.1	--	--	0.1	--	--	--	--
Traill	6.0	--	0.4	3.6	0.2	0.8	1.0	--
Walsh	14.7	--	3.0	7.2	0.2	1.1	3.0	0.2
Wells	0.9	--	0.1	0.6	--	0.1	0.1	--
All counties	283.7	--	39.5	88.4	2.3	15.8	133.2	4.5

WEST UNIT

County	All types	Forest type						
		Ponderosa pine	Oak	Elm-ash	Cottonwood	Plains hardwoods	Aspen	Non-stocked
Adams	0.1	--	--	0.1	--	--	--	--
Billings	3.5	--	0.2	1.4	1.5	--	0.2	0.2
Bowman	0.2	--	--	0.1	0.1	--	--	--
Burke	0.5	--	--	0.3	0.2	--	--	--
Burleigh	5.1	--	0.4	2.2	1.9	--	0.2	0.4
Divide	0.2	--	--	0.1	0.1	--	--	--
Dunn	11.6	0.2	1.4	3.2	1.9	--	3.5	1.4
Emmons	2.9	--	0.2	1.2	1.2	--	0.1	0.2
Golden Valley	1.3	--	--	0.8	0.4	--	--	0.1
Grant	1.0	--	0.1	0.4	0.3	--	--	0.2
Hettinger	0.2	--	--	0.1	0.1	--	--	--
McKenzie	4.7	0.2	0.1	1.4	1.9	--	1.0	0.1
McLean	4.8	--	0.6	2.3	1.2	--	0.3	0.4
Mercer	1.6	--	0.2	0.7	0.4	--	0.1	0.2
Morton	2.9	--	0.3	1.5	0.7	--	0.1	0.3
Mountrail	5.6	--	0.4	3.3	1.2	--	0.3	0.4
Oliver	1.4	--	0.2	0.7	0.3	--	--	0.2
Renville	0.5	--	--	0.3	0.1	--	0.1	--
Slope	2.5	1.7	--	0.2	0.5	--	0.1	--
Sheridan	0.1	--	--	0.1	--	--	--	--
Sioux	1.6	--	0.1	1.2	0.2	--	--	0.1
Stark	2.8	--	0.2	1.7	0.6	--	0.1	0.2
Ward	3.4	--	0.2	1.4	1.4	--	0.2	0.2
Williams	1.0	--	0.1	0.6	0.2	--	--	0.1
All countis	59.5	2.1	4.7	25.3	16.4	--	6.3	4.7
All units	343.2	2.1	44.2	113.7	18.7	15.8	139.5	9.2

Table 16.--Area of commercial forest land by forest type and stand-age class, North Dakota, 1980

(In thousand acres)

Forest type	All classes	Stand-age class (years)												
		1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	101-120	121-140	141+
Ponderosa pine	2.1	--	--	--	--	--	--	2.1	--	--	--	--	--	--
Oak	44.2	2.3	2.3	--	3.4	7.8	16.2	3.4	4.5	2.6	1.7	--	--	--
Elm-ash	113.7	17.6	13.9	--	2.5	3.6	6.6	10.5	11.3	13.0	8.6	19.9	6.2	--
Cottonwood	18.7	2.5	2.4	--	3.0	2.3	--	--	--	3.3	--	5.2	--	--
Plains hardwoods	15.8	--	--	--	--	--	--	2.3	1.6	4.6	5.0	2.3	--	--
Aspen	139.5	28.8	12.5	6.1	20.2	47.1	14.6	5.0	5.2	--	--	--	--	--
Nonstocked	9.2	7.5	--	--	--	1.7	--	--	--	--	--	--	--	--
All types	343.2	58.7	31.1	6.1	29.1	62.5	37.4	23.3	22.6	23.5	15.3	27.4	6.2	--

Table 17.--Area of commercial forest land by forest type, stand-size class, and Forest Survey Unit, North Dakota, 1980

(In thousand acres)

Forest type	All stands	Stand-size class			
		Sawtimber stands	Poletimber stands	Sapling and seedling stands	Nonstocked areas
ALL UNITS					
Ponderosa pine	2.1	--	2.1	--	--
Oak	44.2	5.0	34.5	4.7	--
Elm-ash	113.7	62.9	19.2	31.6	--
Cottonwood	18.7	10.9	3.0	4.8	--
Plains hardwoods	15.8	13.5	2.3	--	--
Aspen	139.5	5.2	88.7	45.6	--
Nonstocked	9.2	--	--	--	9.2
All types	343.2	97.5	149.8	86.7	9.2
EAST UNIT					
Ponderosa pine	--	--	--	--	--
Oak	39.5	5.0	29.8	4.7	--
Elm-ash	88.4	56.0	14.3	18.1	--
Cottonwood	2.3	2.3	--	--	--
Plains hardwoods	15.8	13.5	2.3	--	--
Aspen	133.2	5.2	86.9	41.1	--
Nonstocked	4.5	--	--	--	4.5
All types	283.7	82.0	133.3	63.9	4.5
WEST UNIT					
Ponderosa pine	2.1	--	2.1	--	--
Oak	4.7	--	4.7	--	--
Elm-ash	25.3	6.9	4.9	13.5	--
Cottonwood	16.4	8.6	3.0	4.8	--
Plains hardwoods	--	--	--	--	--
Aspen	6.3	--	1.8	4.5	--
Nonstocked	4.7	--	--	--	4.7
All types	59.5	15.5	16.5	22.8	4.7

Table 18.--Area of commercial forest land by forest type, stand-size class, and site class, North Dakota, 1980

(In thousand acres)

Forest type and stand-size class	All classes	Site class (Cubic feet of growth/acre/year) 85+	50-84	20-49
Ponderosa pine				
Sawtimber	--	--	--	--
Poletimber	2.1	--	--	2.1
Sapling & seedling	--	--	--	--
All stands	2.1	--	--	2.1
Oak				
Sawtimber	5.0	--	5.0	--
Poletimber	34.5	--	3.4	31.1
Sapling & seedling	4.7	--	2.3	2.4
All stands	44.2	--	10.7	33.5
Elm-ash				
Sawtimber	62.9	3.4	5.6	53.9
Poletimber	19.2	--	1.7	17.5
Sapling & seedling	31.6	--	9.1	22.5
All stands	113.7	3.4	16.4	93.9
Cottonwood				
Sawtimber	10.9	3.4	2.3	5.2
Poletimber	3.0	3.0	--	--
Sapling & seedling	4.8	--	--	4.8
All stands	18.7	6.4	2.3	10.0
Plains hardwoods				
Sawtimber	13.5	--	3.3	10.2
Poletimber	2.3	--	--	2.3
Sapling & seedling	--	--	--	--
All stands	15.8	--	3.3	12.5
Aspen				
Sawtimber	5.2	--	5.2	--
Poletimber	88.7	2.6	60.0	26.1
Sapling & seedling	45.6	3.3	14.8	27.5
All stands	139.5	5.9	80.0	53.6
Nonstocked	9.2	--	--	9.2
All types				
Sawtimber	97.5	6.8	21.4	69.3
Poletimber	149.8	5.6	65.1	79.1
Sapling & seedling	86.7	3.3	26.2	57.2
Nonstocked	9.2	--	--	9.2
All stands	343.2	15.7	112.7	214.8

Table 19.--Area of commercial forest land by forest type, stand-size class, and stocking percent, North Dakota, 1980

(In thousand acres)

Forest type and stand-size class	All classes	Stocking percent of growing-stock trees				
		Less than 18	18-60	61-100	101-133	134+
Ponderosa pine						
Sawtimber	--	--	--	--	--	--
Poletimber	2.1	--	--	2.1	--	--
Sapling & seedling	--	--	--	--	--	--
All stands	2.1	--	--	2.1	--	--
Oak						
Sawtimber	5.0	--	--	3.3	--	1.7
Poletimber	34.5	--	18.8	14.0	--	1.7
Sapling & seedling	4.7	--	2.3	2.4	--	--
All stands	44.2	--	21.1	19.7	--	3.4
Elm-ash						
Sawtimber	62.9	--	39.9	17.4	5.6	--
Poletimber	19.2	--	15.1	4.1	--	--
Sapling & seedling	31.6	--	16.6	12.0	3.0	--
All stands	113.7	--	71.6	33.5	8.6	--
Cottonwood						
Sawtimber	10.9	--	9.2	1.7	--	--
Poletimber	3.0	--	--	3.0	--	--
Sapling & seedling	4.8	--	4.8	--	--	--
All stands	18.7	--	14.0	4.7	--	--
Plains hardwoods						
Sawtimber	13.5	--	4.6	7.2	1.7	--
Poletimber	2.3	--	2.3	--	--	--
Sapling & seedling	--	--	--	--	--	--
All stands	15.8	--	6.9	7.2	1.7	--
Aspen						
Sawtimber	5.2	--	2.6	2.6	--	--
Poletimber	88.7	--	25.3	53.1	10.3	--
Sapling & seedling	45.6	--	22.5	14.7	5.8	2.6
All stands	139.5	--	50.4	70.4	16.1	2.6
Nonstocked	9.2	9.2	--	--	--	--
All types						
Sawtimber	97.5	--	56.3	32.2	7.3	1.7
Poletimber	149.8	--	61.5	76.3	10.3	1.7
Sapling & seedling	86.7	--	46.2	29.1	8.8	2.6
Nonstocked	9.2	9.2	--	--	--	--
All stands	343.2	9.2	164.0	137.6	26.4	6.0

Table 20.--Area of commercial forest land by forest type, site-index class, and Forest Survey Unit, North Dakota, 1980

(In thousand acres)

Forest type	All classes	Site-index class (feet)								
		10-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	90+
ALL UNITS										
Ponderosa pine	2.1	--	--	2.1	--	--	--	--	--	--
Oak	44.2	--	7.6	2.8	17.5	14.0	2.3	--	--	--
Elm-ash	113.7	--	--	31.5	37.0	25.4	14.1	4.0	1.7	--
Cottonwood	18.7	--	--	4.2	4.1	--	1.7	2.3	3.0	3.4
Plains hardwoods	15.8	--	--	5.6	4.6	2.3	3.3	--	--	--
Aspen	139.5	--	--	15.7	15.9	44.8	52.0	11.1	--	--
Nonstocked	9.2	--	--	4.5	1.7	3.0	--	--	--	--
All types	343.2	--	7.6	66.4	80.8	89.5	73.4	17.4	4.7	3.4
EAST UNIT										
Ponderosa pine	--	--	--	--	--	--	--	--	--	--
Oak	39.5	--	5.9	2.8	14.5	14.0	2.3	--	--	--
Elm-ash	88.4	--	--	19.2	27.4	23.7	14.1	2.3	1.7	--
Cottonwood	2.3	--	--	--	--	--	--	2.3	--	--
Plains hardwoods	15.8	--	--	5.6	4.6	2.3	3.3	--	--	--
Aspen	133.2	--	--	13.9	13.2	44.8	50.2	11.1	--	--
Nonstocked	4.5	--	--	4.5	--	--	--	--	--	--
All types	283.7	--	5.9	46.0	59.7	84.8	69.9	15.7	1.7	--
WEST UNIT										
Ponderosa pine	2.1	--	--	2.1	--	--	--	--	--	--
Oak	4.7	--	1.7	--	3.0	--	--	--	--	--
Elm-ash	25.3	--	--	12.3	9.6	1.7	--	1.7	--	--
Cottonwood	16.4	--	--	4.2	4.1	--	1.7	--	3.0	3.4
Plains hardwoods	--	--	--	--	--	--	--	--	--	--
Aspen	6.3	--	--	1.8	2.7	--	1.8	--	--	--
Nonstocked	4.7	--	--	--	1.7	3.0	--	--	--	--
All types	59.5	--	1.7	20.4	21.1	4.7	3.5	1.7	3.0	3.4

Table 21.--Area of commercial forest land by forest type and basal-area class, North Dakota, 1980

(In thousand acres)

Forest type	All classes	Basal-area class (square feet per acre)									
		11-20	21-40	41-60	61-80	81-100	101-120	121-140	141-160	161-180	180+
Ponderosa pine	2.1	--	--	--	--	2.1	--	--	--	--	--
Oak	44.2	--	3.4	10.7	17.0	3.0	3.4	3.4	3.3	--	--
Elm-ash	113.7	4.8	11.3	16.9	27.9	32.0	12.4	3.3	1.7	1.7	1.7
Cottonwood	18.7	2.5	2.3	2.3	5.2	3.0	--	1.7	--	1.7	--
Plains hardwoods	15.8	--	--	2.3	--	6.7	3.4	1.7	1.7	--	--
Aspen	139.5	12.0	10.7	26.2	46.0	31.7	5.2	7.7	--	--	--
Nonstocked	9.2	4.5	3.0	--	1.7	--	--	--	--	--	--
All types	343.2	23.8	30.7	58.4	97.8	78.5	24.4	17.8	6.7	3.4	1.7

Table 22.--Area of commercial forest land by forest type and distance to road, North Dakota, 1980

(In thousand acres)

Forest type	Total	Distance to road (miles)							
		0-1/8	1/8-1/4	1/4-1	1-2 1/2	2 1/2-5	5-10	10-20	20+
Ponderosa pine	2.1	--	--	2.1	--	--	--	--	--
Oak	44.2	15.1	10.2	13.3	2.3	--	--	3.3	--
Elm-ash	113.7	38.6	28.6	42.5	1.7	2.3	--	--	--
Cottonwood	18.7	1.6	4.2	12.9	--	--	--	--	--
Plains hardwoods	15.8	5.6	5.6	4.6	--	--	--	--	--
Aspen	139.5	18.0	36.8	77.3	2.5	--	--	4.9	--
Nonstocked	9.2	1.1	3.0	5.1	--	--	--	--	--
All types	343.2	80.0	88.4	157.8	6.5	2.3	--	8.2	--

Table 23.--Area of commercial forest land by forest type and distance to water, North Dakota, 1980

(In thousand acres)

Forest type	Total	Distance to water (miles)							
		0-1/8	1/8-1/4	1/4-1	1-2 1/2	2 1/2-5	5-10	10-20	20+
Ponderosa pine	2.1	--	--	2.1	--	--	--	--	--
Oak	44.2	1.7	5.0	3.5	7.7	7.1	12.3	4.6	2.3
Elm-ash	113.7	49.0	12.7	12.1	9.1	16.2	9.6	5.0	--
Cottonwood	18.7	4.8	3.0	6.9	1.7	2.3	--	--	--
Plains hardwoods	15.8	6.1	1.7	3.4	2.3	--	--	--	2.3
Aspen	139.5	42.1	16.4	36.1	16.4	7.7	10.5	10.3	--
Nonstocked	9.2	6.4	--	1.1	--	1.7	--	--	--
All types	343.2	110.1	38.8	65.2	37.2	35.0	32.4	19.9	4.6

Table 24.--Area of commercial forest land by forest type and stand area class, North Dakota, 1980

(In thousand acres)

Forest type	All classes	Stand area class (acres)								
		1-4	5-9	10-19	20-39	40-79	159	319	639	640+
Ponderosa pine	2.1	--	--	--	--	--	2.1	--	--	--
Oak	44.2	10.6	3.4	9.4	1.1	10.0	6.7	--	3.0	--
Elm-ash	113.7	43.1	20.7	12.6	12.6	8.9	10.7	--	5.1	--
Cottonwood	18.7	9.4	4.1	--	--	--	5.2	--	--	--
Plains hardwoods	15.8	3.4	2.3	5.6	4.5	--	--	--	--	--
Aspen	139.5	36.2	19.5	14.4	25.8	22.9	10.2	8.9	1.6	--
Nonstocked	9.2	4.7	--	1.1	3.4	--	--	--	--	--
All types	343.2	107.4	50.0	43.1	47.4	41.8	34.9	8.9	9.7	--

Table 25.--Area of commercial forest land by stocking class based on selected stand components, North Dakota, 1980

(In thousand acres)

Stocking percentage	Stocking classified in terms of				
	All trees	Growing-stock trees	Desirable trees	Acceptable trees	Rough and rotten trees
0-10	--	4.1	339.8	4.1	53.7
11-20	--	11.7	1.7	11.7	46.8
21-30	2.5	22.7	1.7	22.7	72.3
31-40	6.5	31.8	--	33.5	40.1
41-50	3.4	54.4	--	56.9	45.3
51-60	16.6	48.6	--	46.0	30.9
61-70	16.8	41.8	--	43.5	21.1
71-80	38.5	38.7	--	37.0	19.4
81-90	45.0	27.9	--	29.6	5.3
91-100	49.3	29.2	--	25.9	8.3
101-110	45.8	20.1	--	23.1	--
111-120	49.5	4.6	--	3.3	--
121-130	40.0	1.7	--	--	--
131-140	20.0	3.3	--	3.3	--
141-150	9.3	2.6	--	2.6	--
151-160	--	--	--	--	--
161+	--	--	--	--	--
Total	343.2	343.2	343.2	343.2	343.2

Table 26.--Area of noncommercial forest land by forest type and Forest Survey Unit, North Dakota, 1980

(In thousand acres)

Forest type	Total	Unproductive	Forest reserved
ALL UNITS			
Oak	38.7	38.7	--
Elm-ash	107.8	95.3	12.5
Cottonwood	23.0	8.6	14.4
Aspen	5.4	5.4	--
All types	174.9	148.0	26.9
EAST UNIT			
Oak	34.8	34.8	--
Elm-ash	14.6	12.7	1.9
Cottonwood	--	--	--
Aspen	1.7	1.7	--
All types	51.1	49.2	1.9
WEST UNIT			
Oak	3.9	3.9	--
Elm-ash	93.2	82.6	10.6
Cottonwood	23.0	8.6	14.4
Aspen	3.7	3.7	--
All types	123.8	98.8	25.0

Table 27.--Area of nonforest land with trees by land use, forest type, and Forest Survey Unit, North Dakota, 1980

(In thousand acres)

Land use	All types	Forest type: Ponderosa pine	Oak	Elm-ash	Cottonwood	Plains hardwoods	Aspen	Exotic	Non-stocked
ALL UNITS									
Reserved areas	78.0	--	--	37.1	40.9	--	--	--	--
Cropland	44.6	--	2.5	34.7	--	2.5	4.9	--	--
Improved pasture	436.6	7.4	17.3	314.2	85.3	2.5	7.4	--	2.5
Wooded strips	167.0	--	12.0	130.2	2.5	2.5	14.8	2.5	2.5
Idle farmland	9.8	--	--	9.8	--	--	--	--	--
Marsh	14.0	--	--	11.5	--	--	2.5	--	--
Windbreaks	30.1	--	--	27.8	2.3	--	--	--	--
Shelterbelts	187.3	--	--	172.4	--	9.9	--	5.0	--
Wooded pasture	18.3	--	--	8.5	--	2.3	--	--	7.5
All uses	985.7	7.4	31.8	746.2	131.0	19.7	29.6	7.5	12.5
EAST UNIT									
Reserved areas	1.3	--	--	1.3	--	--	--	--	--
Cropland	34.7	--	2.5	24.8	--	2.5	4.9	--	--
Improved pasture	44.6	--	7.4	24.8	--	2.5	7.4	--	2.5
Wooded strips	47.0	--	5.0	27.1	--	2.5	7.4	2.5	2.5
Idle farmland	4.9	--	--	4.9	--	--	--	--	--
Marsh	2.5	--	--	--	--	--	2.5	--	--
Windbreaks	23.4	--	--	21.1	2.3	--	--	--	--
Shelterbelts	135.8	--	--	120.9	--	9.9	--	5.0	--
Wooded pasture	13.8	--	--	4.0	--	2.3	--	--	7.5
All uses	308.0	--	14.9	228.9	2.3	19.7	22.2	7.5	12.5
WEST UNIT									
Reserved areas	76.7	--	--	35.8	40.9	--	--	--	--
Cropland	9.9	--	--	9.9	--	--	--	--	--
Improved pasture	392.0	7.4	9.9	289.4	85.3	--	--	--	--
Wooded strips	120.0	--	7.0	103.1	2.5	--	7.4	--	--
Idle farmland	4.9	--	--	4.9	--	--	--	--	--
Marsh	11.5	--	--	11.5	--	--	--	--	--
Windbreaks	6.7	--	--	6.7	--	--	--	--	--
Shelterbelts	51.5	--	--	51.5	--	--	--	--	--
Wooded pasture	4.5	--	--	4.5	--	--	--	--	--
All uses	677.7	7.4	16.9	517.3	128.7	--	7.4	--	--

Table 28.--Area of nonforest land with trees by forest type and stand-size class, North Dakota, 1980

(In thousand acres)

Forest type	All stands	Stand-size class: Sawtimber stands	Poletimber stands	Sapling and seedling stands	Nonstocked areas
Ponderosa pine	7.4	--	5.0	2.4	--
Oak	31.8	--	19.5	12.3	--
Elm-ash	746.2	141.4	382.6	222.2	--
Cottonwood	131.0	3.3	33.6	94.1	--
Plains hardwoods	19.7	2.3	9.9	7.5	--
Aspen	29.6	--	10.0	19.6	--
Exotic	7.5	2.5	--	5.0	--
Nonstocked	12.5	--	--	--	12.5
All types	985.7	149.5	460.6	363.1	12.5

Table 29.--Number of all live trees on commercial forest land by species group and diameter class, North Dakota, 1980

(In thousand trees)

Species group	All classes	Diameter class (inches at breast height) 1.0-2.9	3.0-4.9	5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-28.9	29.0-38.9	39.0+
SOFTWOODS															
Ponderosa pine	1,090.6	629.1	--	279.1	112.5	59.7	10.2	--	--	--	--	--	--	--	--
Other softwoods	209.7	209.7	--	--	--	--	--	--	--	--	--	--	--	--	--
Total	1,300.3	838.8	--	279.1	112.5	59.7	10.2	--	--	--	--	--	--	--	--
HARDWOODS															
Oak	27,464.6	9,645.0	9,444.5	3,384.7	2,365.2	1,646.9	510.2	229.5	111.6	79.0	31.2	16.8	--	--	--
Basswood	947.5	--	--	68.9	105.0	159.4	275.8	162.5	70.0	45.8	38.2	2.2	19.7	--	--
Elm	7,372.5	1,972.9	1,692.2	788.0	742.3	533.7	487.3	432.7	297.1	156.6	93.3	60.4	93.6	22.4	--
Ash	27,508.4	10,608.3	8,246.1	3,809.2	2,234.6	1,283.7	713.0	367.0	101.4	82.7	41.1	19.4	1.9	--	--
Cottonwood	3,992.9	1,475.6	978.1	534.6	179.9	289.8	161.3	88.1	24.2	27.7	47.3	37.8	96.8	45.0	6.7
Hackberry	233.6	166.1	--	24.7	23.4	--	9.2	5.8	--	4.4	--	--	--	--	--
Balsam poplar	5,727.8	1,783.0	1,547.2	988.2	801.7	384.2	162.3	38.5	22.7	--	--	--	--	--	--
Aspen	61,188.6	31,238.0	13,564.2	7,950.7	4,591.7	2,622.4	855.9	267.0	83.5	10.6	4.6	--	--	--	--
Birch	3,616.8	1,465.4	673.8	782.7	407.9	140.4	102.9	43.7	--	--	--	--	--	--	--
Boxelder	15,108.9	8,296.9	3,052.0	1,537.7	848.1	580.6	308.0	190.4	152.2	66.0	51.1	10.4	10.7	4.8	--
Other hardwoods	913.9	913.9	--	--	--	--	--	--	--	--	--	--	--	--	--
Noncommercial species	7,245.8	6,523.9	330.3	29.1	84.3	78.3	38.3	55.1	38.1	24.0	14.7	15.3	14.4	--	--
Total	161,321.3	74,089.0	39,528.4	19,898.5	12,384.1	7,719.4	3,624.2	1,880.3	900.8	496.8	321.5	162.3	237.1	72.2	6.7
All species	162,621.6	74,927.8	39,528.4	20,177.6	12,496.6	7,779.1	3,634.4	1,880.3	900.8	496.8	321.5	162.3	237.1	72.2	6.7

Table 30.--Number of growing-stock trees on commercial forest land by species group and diameter class, North Dakota, 1980

(In thousand trees)

Species group	All classes	Diameter class (inches at breast height) 1.0-2.9	3.0-4.9	5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-28.9	29.0-38.9	39.0+
SOFTWOODS															
Ponderosa pine	648.6	209.7	--	279.0	90.0	59.7	10.2	--	--	--	--	--	--	--	--
Total	648.6	209.7	--	279.0	90.0	59.7	10.2	--	--	--	--	--	--	--	--
HARDWOODS															
Oak	19,869.3	8,477.1	6,224.1	1,726.2	1,588.0	1,190.3	310.7	174.4	78.2	62.1	24.0	14.2	--	--	--
Basswood	690.6	--	--	37.2	55.2	135.6	217.4	134.0	42.0	35.6	28.6	2.2	2.8	--	--
Elm	5,266.3	1,972.9	1,521.0	248.1	201.7	333.0	257.2	276.9	197.5	105.9	67.1	23.5	59.1	2.4	--
Ash	19,754.4	10,360.5	4,821.8	2,114.8	1,031.7	640.2	415.4	192.3	61.9	71.0	32.5	10.3	2.0	--	--
Cottonwood	3,629.0	1,475.6	978.2	492.3	117.3	189.5	78.2	79.2	15.5	15.0	44.6	37.8	81.9	23.4	0.5
Hackberry	30.5	--	--	24.7	--	--	--	5.8	--	--	--	--	--	--	--
Balsam poplar	5,320.3	1,783.0	1,299.3	974.5	695.3	384.2	132.0	29.3	22.7	--	--	--	--	--	--
Aspen	52,386.8	28,536.2	11,863.1	6,220.0	3,550.2	1,633.4	401.5	157.3	20.5	--	4.6	--	--	--	--
Birch	3,159.1	1,299.2	673.8	666.1	298.7	98.6	102.9	19.8	--	--	0	--	--	--	--
Boxelder	6,874.9	4,690.2	1,225.3	349.9	330.7	175.7	34.8	12.7	36.2	3.5	12.3	3.6	--	--	--
Other hardwoods	913.9	913.9	--	--	--	--	--	--	--	--	--	--	--	--	--
Total	117,895.1	59,508.6	28,606.6	12,853.8	7,868.8	4,780.5	1,950.1	1,081.7	474.5	293.1	213.7	91.6	145.8	25.8	0.5
All species	118,543.7	59,718.3	28,606.6	13,132.8	7,958.8	4,840.2	1,960.3	1,081.7	474.5	293.1	213.7	91.6	145.8	25.8	0.5

Table 31.--Net volume of timber on commercial forest land by class of timber and softwoods and hardwoods, North Dakota, 1980

(In thousand cubic feet)

Class of timber	All species	Softwoods	Hardwoods
LIVE TREES			
Growing-stock trees			
Sawtimber			
Saw log portion	77,502.2	517.9	76,984.3
Upper stem portion	19,093.3	95.1	18,998.2
Subtotal	96,595.5	613.0	95,982.5
Poletimber	110,519.1	1,081.2	109,437.9
Total growing-stock	207,114.6	1,694.2	205,420.4
Cull trees			
Rough and rotten cull trees			
Sawtimber	33,209.7	--	33,209.7
Poletimber	40,798.0	98.1	40,699.9
Subtotal	74,007.7	98.1	73,909.6
Short-log cull trees	14,981.0	--	14,981.0
Total cull	88,988.7	98.1	88,890.6
TOTAL LIVE TREES	296,103.3	1,792.3	294,311.0
SALVABLE DEAD TREES	6,047.5	--	6,047.5
ALL CLASSES	302,150.8	1,792.3	300,358.5

Table 32.--Net volume of growing stock and sawtimber on commercial forest land by county and species category, North Dakota, 1980

EAST UNIT

County	Growing stock						Sawtimber					
	All species	Softwoods	Elm	Ash	Aspen	Other hardwoods	All species	Softwoods	Elm	Ash	Aspen	Other hardwoods
	Thousand cubic feet						Thousand board feet 1/					
Barnes	2,350.5	--	741.2	487.0	61.7	1,060.6	9,300.0	--	3,230.2	1,849.3	88.5	4,132.0
Benson	14,633.4	--	1,522.4	1,371.5	6,898.4	4,841.1	20,536.9	--	7,068.2	3,107.4	2,188.3	8,173.0
Bottineau	26,990.0	--	868.5	2,482.0	15,467.0	8,172.5	31,368.4	--	2,874.9	2,040.3	14,624.7	11,828.5
Cass	5,382.5	--	1,538.2	1,241.2	166.9	2,436.2	20,510.0	--	6,651.2	4,430.1	138.6	9,290.1
Cavalier	23,471.3	--	4,087.0	4,392.5	5,966.3	9,025.5	64,482.2	--	17,262.5	12,875.2	6,041.6	28,302.9
Dickey	442.4	--	134.0	96.1	13.3	199.0	1,715.7	--	577.1	349.4	14.6	774.6
Eddy	2,011.6	--	461.2	440.5	209.9	900.0	6,694.2	--	2,114.2	1,600.8	53.4	2,925.8
Foster	143.4	--	36.7	39.1	5.6	62.0	542.3	--	159.3	135.1	1.4	246.5
Grand Forks	5,768.8	--	1,501.8	1,314.9	373.2	2,578.9	20,623.8	--	6,536.9	4,589.4	156.8	9,340.7
Griggs	1,777.9	--	499.7	432.4	60.9	784.9	6,815.9	--	2,158.7	1,530.9	39.4	3,086.9
Kidder	--	--	--	--	--	--	--	--	--	--	--	--
LaMoure	620.6	--	172.5	153.2	21.6	273.3	2,379.4	--	745.7	540.6	12.8	1,080.3
Logan	49.3	--	16.0	9.4	1.3	22.6	193.3	--	68.8	35.3	2.2	87.0
McHenry	8,601.0	--	2,180.0	1,990.4	315.9	4,114.7	30,769.1	--	9,651.0	7,026.7	155.3	13,936.1
McIntosh	100.4	--	32.7	19.1	2.6	46.0	393.9	--	140.2	71.9	4.4	177.4
Nelson	3,048.8	--	803.2	751.8	81.1	1,412.7	11,478.2	--	3,594.2	2,729.0	48.6	5,106.4
Pembina	13,180.6	--	2,219.1	2,160.7	2,432.1	6,368.7	31,310.8	--	9,682.3	6,345.5	534.6	14,748.4
Pierce	1,152.8	--	315.8	290.2	41.1	505.7	4,402.9	--	1,365.8	1,019.5	21.5	1,996.1
Ramsey	1,362.0	--	230.6	185.2	474.4	471.8	2,995.2	--	1,031.1	562.8	123.1	1,278.2
Ransom	6,958.3	--	1,818.1	1,585.9	366.7	3,187.6	24,917.4	--	7,872.4	5,597.2	139.1	11,308.7
Richland	6,102.1	--	1,594.6	1,546.4	181.1	2,780.0	22,997.1	--	7,085.0	5,538.9	87.3	10,285.9
Rolette	36,895.4	--	940.0	2,718.5	23,635.4	9,601.5	38,985.9	--	3,406.1	1,409.3	21,747.5	12,423.0
Sargent	400.0	--	130.2	76.1	10.4	183.3	1,569.3	--	558.8	286.6	17.6	706.3
Steele	1,332.5	--	413.8	277.4	38.3	603.0	5,187.9	--	1,779.6	1,019.6	48.8	2,339.9
Stutsman	936.8	--	295.0	190.1	26.2	425.5	3,655.5	--	1,267.9	703.5	36.3	1,647.8
Towner	50.1	--	16.3	9.5	1.3	23.0	196.4	--	69.9	35.9	2.2	88.4
Traill	3,366.3	--	1,015.3	736.4	102.4	1,512.2	13,044.8	--	4,371.9	2,673.5	108.6	5,890.8
Walsh	11,072.0	--	2,431.7	2,241.9	1,147.9	5,250.5	34,877.0	--	11,146.5	7,925.7	346.4	15,458.4
Wells	545.5	--	157.3	128.0	18.0	242.2	2,099.0	--	678.5	456.9	14.0	949.6
Total	178,746.3	--	26,172.9	27,367.4	58,121.0	67,085.0	414,042.5	--	113,148.9	76,486.3	46,797.6	177,609.7

(Table 32 continued on next page)

(Table 32 continued)

WEST UNIT

County	Growing stock						Sawtimber					
	All species	Softwoods	Elm	Ash	Aspen	Other hardwoods	All species	Softwoods	Elm	Ash	Aspen	Other hardwoods
	Thousand cubic feet						Thousand board feet[1]					
Adams	13.7	--	--	0.6	0.8	12.3	29.3	--	--	2.0	1.8	25.5
Billings	1,680.9	--	56.9	221.2	73.4	1,329.4	6,145.0	--	235.8	399.0	48.5	5,461.7
Bowman	48.9	--	--	2.3	3.1	43.5	116.5	--	--	7.9	7.2	101.4
Burke	180.4	--	28.3	36.8	5.9	109.4	655.7	--	109.9	65.4	--	480.4
Burleigh	3,630.8	--	258.9	346.6	72.5	2,952.8	15,625.9	--	1,012.1	640.5	46.3	13,927.0
Divide	5.5	--	--	--	--	5.5	--	--	--	--	--	--
Dunn	4,544.0	151.0	139.7	389.5	1,023.1	2,840.7	9,960.3	281.0	645.3	716.0	433.3	7,884.7
Emmons	2,286.9	--	78.7	235.1	34.2	1,938.9	9,889.5	--	312.1	432.1	42.9	9,102.4
Golden Valley	268.8	--	30.6	39.9	9.1	189.2	798.5	--	123.3	74.8	7.2	593.2
Grant	301.8	--	4.0	14.2	19.2	264.4	754.3	--	27.4	49.2	44.8	632.9
Hettinger	27.2	--	--	1.1	1.5	24.6	58.3	--	--	4.0	3.6	50.7
McKenzie	1,801.1	157.5	61.4	587.4	157.4	837.4	4,688.6	293.0	245.2	1,017.8	18.4	3,114.2
McLean	2,628.4	--	269.3	357.1	73.0	1,929.0	10,409.6	--	1,057.7	657.2	42.5	8,652.2
Mercer	715.5	--	85.7	120.3	30.0	479.5	2,445.2	--	332.0	229.1	28.6	1,855.5
Morton	1,199.8	--	114.1	171.3	54.9	859.5	3,825.8	--	442.0	343.7	73.1	2,967.0
Mountrail	2,238.7	--	306.7	407.0	82.8	1,442.2	7,783.5	--	1,202.9	748.5	47.5	5,784.6
Oliver	455.1	--	12.6	30.7	26.9	384.9	1,184.1	--	58.1	85.7	58.2	982.1
Renville	174.6	--	19.5	27.6	7.2	120.3	569.5	--	75.5	53.0	7.3	433.7
Slope	1,487.4	1,385.7	9.6	12.5	2.0	77.6	2,801.0	2,578.5	37.3	22.2	--	163.0
Sheridan	25.6	--	0.8	1.1	1.5	22.2	63.4	--	5.5	3.9	3.6	50.4
Sioux	422.0	--	50.7	67.2	14.9	289.2	1,324.9	--	201.3	125.3	11.0	987.3
Stark	1,239.9	--	137.5	426.2	37.6	638.6	3,911.3	--	544.7	752.3	23.3	2,591.0
Ward	2,637.9	--	172.9	232.0	45.8	2,187.2	11,639.6	--	670.2	424.8	23.4	10,521.2
Williams	353.4	--	47.6	64.1	12.9	228.8	1,216.6	--	184.4	117.7	7.1	907.4
Total	28,368.3	1,694.2	1,885.5	3,791.8	1,789.7	19,207.1	95,896.4	3,152.5	7,522.7	6,972.1	979.6	77,269.5
All units	207,114.6	1,694.2	28,058.4	31,159.2	59,910.7	86,292.1	509,938.9	3,152.5	120,671.6	83,458.4	447,777.2	254,879.2

[1] International 1/4-inch rule.

Table 33.--Net volume of growing-stock, sawtimber, short-log, and rough and rotten trees on commercial forest land by individual species, North Dakota, 1980

Species	Total all live	Growing stock	Short-log	Rough and rotten	Sawtimber
	Thousand cubic feet				Thousand board feet[1]
SOFTWOODS					
Ponderosa pine	1,792.3	1,694.2	--	98.1	3,152.5
Total	1,792.3	1,694.2	--	98.1	3,152.5
HARDWOODS					
Boxelder	18,968.6	5,320.7	2,019.1	11,628.8	9,456.7
River birch	74.9	--	--	74.9	--
Paper birch	7,141.1	6,038.3	335.1	767.7	9,303.7
Hackberry	343.4	178.6	98.0	66.8	621.7
Black ash	932.6	118.8	--	813.8	--
Green ash	46,814.4	31,040.4	1,518.5	14,255.5	83,458.4
Balsam poplar	12,599.7	12,006.8	136.2	456.7	13,510.6
Eastern cottonwood	22,636.1	17,038.5	1,834.8	3,762.8	73,058.2
Plains cottonwood	7,399.1	6,359.4	637.6	402.1	32,729.4
Quaking aspen	76,658.4	59,910.7	489.8	16,257.9	47,777.2
Bur oak	39,935.6	29,229.6	1,749.7	8,956.3	66,082.6
American basswood	11,971.3	10,120.2	406.1	1,445.0	50,116.3
American elm	44,019.9	27,861.3	5,756.1	10,402.5	120,671.6
Slippery elm	197.1	197.1	--	--	--
Noncommercial species	4,618.8	--	--	4,618.8	--
Total	294,311.0	205,420.4	14,981.0	73,909.6	506,786.4
All species	296,103.3	207,114.6	14,981.0	74,007.7	509,938.9

[1] International 1/4-inch rule.

Table 34.--Net volume of growing stock on commercial forest land by species group and diameter class, North Dakota, 1980

(In thousand cubic feet)

Species group	All classes	Diameter class (inches at breast height) 5.0-6.9	7.0-8.9	9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-28.9	29.0-38.9	39.0+
SOFTWOODS													
Ponderosa pine	1,694.2	626.6	454.7	483.0	129.9	--	--	--	--	--	--	--	--
Total	1,694.2	626.6	454.7	483.0	129.9	--	--	--	--	--	--	--	--
HARDWOODS													
Oak	29,229.6	2,923.9	6,418.0	8,487.2	3,387.0	2,786.5	1,658.0	1,874.5	1,002.3	692.2	--	--	--
Basswood	10,120.2	51.5	286.7	957.5	2,843.0	2,503.6	959.2	1,119.9	1,131.2	115.1	152.5	--	--
Elm	28,058.4	408.0	949.2	2,716.2	3,270.4	4,711.1	4,755.7	3,189.5	2,675.8	1,183.6	3,894.7	304.2	--
Ash	31,159.2	4,608.7	5,182.5	5,547.7	5,581.1	3,908.7	1,852.9	2,259.5	1,546.3	552.3	119.5	--	--
Cottonwood	23,397.9	993.8	737.7	1,477.9	1,106.1	1,599.8	473.3	605.3	1,965.6	2,354.6	8,306.5	3,644.5	132.8
Hackberry	178.6	54.2	--	--	--	124.4	--	--	--	--	--	--	--
Balsam poplar	12,006.8	2,187.2	3,548.4	3,424.5	1,595.3	499.7	751.7	--	--	--	--	--	--
Aspen	59,910.7	15,873.9	19,289.4	15,605.7	5,422.0	2,981.9	531.9	--	205.9	--	--	--	--
Birch	6,038.3	1,887.3	1,524.8	918.6	1,268.6	439.0	--	--	--	--	--	--	--
Boxelder	5,320.7	819.2	1,424.3	1,133.7	418.9	201.9	608.4	90.1	513.4	110.8	--	--	--
Total	205,420.4	29,807.7	39,361.0	40,269.0	24,892.4	19,756.6	11,591.1	9,138.8	9,040.5	5,008.6	12,473.2	3,948.7	132.8
All species	207,114.6	30,434.3	39,815.7	40,752.0	25,022.3	19,756.6	11,591.1	9,138.8	9,040.5	5,008.6	12,473.2	3,948.7	132.8

Table 35.--Net volume of sawtimber on commercial forest land by species group and diameter class, North Dakota, 1980

(In thousand board feet)[1/]

Species group	All classes	Diameter class (inches at breast height) 9.0-10.9	11.0-12.9	13.0-14.9	15.0-16.9	17.0-18.9	19.0-20.9	21.0-22.9	23.0-28.9	29.0-38.9	39.0+
SOFTWOODS											
Ponderosa pine	3,152.5	2,562.9	589.6	--	--	--	--	--	--	--	--
Total	3,152.5	2,562.9	589.6	--	--	--	--	--	--	--	--
HARDWOODS											
Oak	66,082.6	--	20,198.7	16,304.3	9,177.1	10,862.6	5,976.0	3,563.9	--	--	--
Basswood	50,116.3	--	15,101.0	14,950.1	5,375.7	6,594.1	7,033.7	658.1	403.6	--	--
Elm	120,671.6	--	16,309.8	23,903.8	23,198.2	16,621.3	12,911.1	5,917.4	19,847.1	1,962.9	--
Ash	83,458.4	--	28,664.5	20,057.6	10,752.7	11,452.7	8,482.5	3,399.7	648.7	--	--
Cottonwood	105,787.6	--	5,409.4	7,931.9	2,584.0	3,334.1	11,150.9	13,069.8	43,918.4	17,656.6	732.5
Hackberry	621.7	--	--	621.7	--	--	--	--	--	--	--
Balsam poplar	13,510.6	--	7,668.6	2,744.2	3,097.8	--	--	--	--	--	--
Aspen	47,777.2	--	27,450.2	15,609.3	3,490.0	--	1,227.7	--	--	--	--
Birch	9,303.7	--	6,716.4	2,587.3	--	--	--	--	--	--	--
Boxelder	9,456.7	--	2,082.0	1,001.5	3,242.8	465.2	2,405.2	260.0	--	--	--
Total	506,786.4	--	129,600.6	105,711.7	60,918.3	49,330.0	49,187.1	26,868.9	64,817.8	19,619.5	732.5
All species	509,938.9	2,562.9	130,190.2	105,711.7	60,918.3	49,330.0	49,187.1	26,868.9	64,817.8	19,619.5	732.5

[1/] International 1/4-inch rule.

Table 36.--Net volume of growing stock on commercial forest land by species group and ownership class, North Dakota, 1980

(In thousand cubic feet)

Species group	All owners	Ownership class						
		National Forest	Misc. federal	Indian	State	County & municipal	Farmer	Misc. private
SOFTWOODS								
Ponderosa pine	1,694.2	--	--	--	--	--	1,694.2	--
Total	1,694.2	--	--	--	--	--	1,694.2	--
HARDWOODS								
Oak	29,229.6	229.6	--	1,170.1	732.6	884.2	25,429.0	784.1
Basswood	10,120.2	--	--	115.8	--	--	10,004.4	--
Elm	28,058.4	--	--	747.9	--	115.4	26,413.3	781.8
Ash	31,159.2	--	1,005.5	670.1	1,288.1	--	27,478.1	717.4
Cottonwood	23,397.9	259.9	1,414.2	--	--	--	20,567.7	1,156.1
Hackberry	178.6	--	--	--	--	--	178.6	--
Balsam poplar	12,006.8	--	985.0	415.6	2,673.0	--	7,466.2	467.0
Aspen	59,910.7	135.1	1,058.8	7,100.1	9,708.7	--	41,078.5	829.5
Birch	6,038.3	--	--	--	2,214.5	--	3,778.6	45.2
Boxelder	5,320.7	--	--	--	--	--	5,320.7	--
Total	205,420.4	624.6	4,463.5	10,219.6	16,616.9	999.6	167,715.1	4,781.1
All species	207,114.6	624.6	4,463.5	10,219.6	16,616.9	999.6	169,409.3	4,781.1

Table 37.--Net volume of sawtimber on commercial forest land by species group and ownership class, North Dakota, 1980

(In thousand board feet)[1/]

Species group	All owners	Ownership class					
		Misc. federal	Indian	State	County & municipal	Farmer	Misc. private
SOFTWOODS							
Ponderosa pine	3,152.5	--	--	--	--	3,152.5	--
Total	3,152.5	--	--	--	--	3,152.5	--
HARDWOODS							
Oak	66,082.6	--	--	2,611.6	727.2	59,602.5	3,141.3
Basswood	50,116.3	--	741.7	--	--	49,374.6	--
Elm	120,671.6	--	4,294.6	--	--	112,732.8	3,644.2
Ash	83,458.4	1,715.5	641.7	--	--	78,653.2	2,448.0
Cottonwood	105,787.6	8,235.7	--	--	--	91,238.7	6,313.2
Hackberry	621.7	--	--	--	--	621.7	--
Balsam poplar	13,510.6	643.4	--	--	2,754.4	10,112.8	--
Aspen	47,777.2	1,433.3	1,152.6	--	13,744.1	31,447.2	--
Birch	9,303.7	--	--	--	6,181.0	3,122.7	--
Boxelder	9,456.7	--	--	--	--	9,456.7	--
Total	506,786.4	12,027.9	6,830.6	2,611.6	23,406.7	446,362.9	15,546.7
All species	509,938.9	12,027.9	6,830.6	2,611.6	23,406.7	449,515.4	15,546.7

[1/]International 1/4-inch rule.

Table 38.--Net volume of growing stock on commercial forest land by forest type and stand-age class, North Dakota, 1980

(In thousand cubic feet)

Forest type	All classes	Stand-age class (years)												
		0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	101-120	121-140	141+
Ponderosa pine	1,694.2	--	--	--	--	--	--	1,694.2	--	--	--	--	--	--
Oak	26,368.4	364.8	730.9	--	1,036.5	2,706.2	9,168.3	5,434.2	2,230.9	1,209.8	3,486.8	--	--	--
Elm-ash	65,557.2	5,276.7	704.0	--	3,170.0	1,887.4	1,926.8	9,390.0	5,935.2	11,989.2	5,706.9	15,202.7	4,368.3	--
Cottonwood	16,759.7	77.3	259.9	--	3,698.6	1,926.1	--	--	--	3,282.3	--	7,515.5	--	--
Plains hardwoods	16,651.4	--	--	--	--	--	--	588.3	3,286.2	3,762.0	7,624.6	1,390.3	--	--
Aspen	80,012.2	3,958.6	1,897.6	1,433.2	12,634.4	36,698.1	13,761.4	5,129.1	4,499.8	--	--	--	--	--
Nonstocked	71.5	--	--	--	--	71.5	--	--	--	--	--	--	--	--
All types	207,114.6	9,677.4	3,592.4	1,433.2	20,539.5	43,289.3	24,856.5	22,235.8	15,952.1	20,243.3	16,818.3	24,108.5	4,368.3	--

Table 39.--Net volume of sawtimber on commercial forest land by forest type and stand-age class, North Dakota, 1980

(In thousand board feet)[1/]

Forest type	All classes	Stand-age class (years)												
		0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	101-120	121-140	141+
Ponderosa pine	3,152.5	--	--	--	--	--	--	3,152.5	--	--	--	--	--	--
Oak	46,866.2	--	--	--	--	1,777.6	14,744.5	12,173.9	3,296.1	569.9	14,304.2	--	--	--
Elm-ash	245,939.3	22,941.0	2,086.3	--	4,004.1	3,722.1	1,152.8	30,887.6	19,224.4	46,494.1	22,421.0	70,468.3	22,537.6	--
Cottonwood	69,794.3	--	--	--	5,616.0	9,648.6	--	--	--	15,487.1	--	39,042.6	--	--
Plains hardwood	75,605.7	--	--	--	--	--	--	1,383.4	18,825.0	17,902.0	33,268.3	4,227.0	--	--
Aspen	68,580.9	1,754.6	1,693.9	771.8	5,163.7	24,533.4	14,848.1	5,094.0	14,721.4	--	--	--	--	--
Nonstocked	--	--	--	--	--	--	--	--	--	--	--	--	--	--
All types	509,938.9	24,695.6	3,780.2	771.8	14,783.8	39,681.7	30,745.4	52,691.4	56,066.9	80,453.1	69,993.5	113,737.9	22,537.6	--

[1/] International 1/4-inch rule.

Table 40.--Net volume of growing stock on commercial forest land by species group and forest type, North Dakota, 1980

(In thousand cubic feet)

Species group	All types	Forest type						
		Ponderosa pine	Oak	Elm-ash	Cottonwood	Plains hardwoods	Aspen	Non-stocked
SOFTWOODS								
Ponderosa pine	1,694.2	1,694.2	--	--	--	--	--	--
Total	1,694.2	1,694.2	--	--	--	--	--	--
HARDWOODS								
Oak	29,229.6	--	17,284.3	5,470.4	--	3,799.1	2,675.8	--
Basswood	10,120.2	--	2,321.5	699.5	--	7,099.2	--	--
Elm	28,058.4	--	1,335.4	21,650.7	198.5	4,040.3	833.5	--
Ash	31,159.2	--	3,221.9	23,390.6	76.1	1,212.4	3,186.7	71.5
Cottonwood	23,397.9	--	--	7,165.0	16,232.9	--	--	--
Hackberry	178.6	--	--	178.6	--	--	--	--
Balsam poplar	12,006.8	--	165.4	1,672.6	--	--	10,168.8	--
Aspen	59,910.7	--	972.7	934.6	--	224.8	57,778.6	--
Birch	6,038.3	--	1,067.2	--	--	--	4,971.1	--
Boxelder	5,320.7	--	--	4,395.2	252.2	275.6	397.7	--
Total	205,420.4	--	26,368.4	65,557.2	16,759.7	16,651.4	80,012.2	71.5
All species	207,114.6	1,694.2	26,368.4	65,557.2	16,759.7	16,651.4	80,012.2	71.5

Table 41.--Net volume of sawtimber on commercial forest land by species group and forest type, North Dakota, 1980

(In thousand board feet)[1/]

Species group	All types	Forest type					
		Ponderosa pine	Oak	Elm-ash	Cottonwood	Plains hardwoods	Aspen
SOFTWOODS							
Ponderosa pine	3,152.5	3,152.5	--	--	--	--	--
Total	3,152.5	3,152.5	--	--	--	--	--
HARDWOODS							
Oak	66,082.6	--	28,396.6	27,977.9	--	8,403.8	1,304.3
Basswood	50,116.3	--	7,620.3	3,030.0	--	39,466.0	--
Elm	120,671.6	--	6,224.8	92,315.3	394.1	18,432.2	3,305.2
Ash	83,458.4	--	3,644.9	72,717.9	--	7,095.6	--
Cottonwood	105,787.6	--	--	36,387.4	69,400.2	--	--
Hackberry	621.7	--	--	621.7	--	--	--
Balsam poplar	13,510.6	--	--	3,187.3	--	--	10,323.3
Aspen	47,777.2	--	979.6	1,161.5	--	1,291.7	44,344.4
Birch	9,303.7	--	--	--	--	--	9,303.7
Boxelder	9,456.7	--	--	8,540.3	--	916.4	--
Total	506,786.4	--	46,866.2	245,939.3	69,794.3	75,605.7	68,580.9
All species	509,938.9	3,152.5	46,866.2	245,939.3	69,794.3	75,605.7	68,580.9

[1/]International 1/4-inch rule.

Table 42.--Net volume of sawtimber on commercial forest land by species group and butt log-grade class, North Dakota, 1980

(In thousand board feet)[1/]

Species group	All grades	Butt log-grade class			
		1	2	3	Tie and timber
SOFTWOODS					
Ponderosa pine	3,152.5	--	--	3,152.5	--
Total	3,152.5	--	--	3,152.5	--
HARDWOODS					
Oak	66,082.6	521.9	7,306.7	37,135.2	21,118.8
Basswood	50,116.3	11,526.2	17,390.4	20,596.4	603.3
Elm	120,671.6	11,000.9	35,911.5	64,618.9	9,140.3
Ash	83,458.4	5,140.5	21,067.5	44,489.2	12,761.2
Cottonwood	105,787.6	25,667.9	30,667.4	44,456.9	4,995.4
Hackberry	621.7	--	--	621.7	--
Balsam poplar	13,510.6	1,140.7	4,160.3	6,644.6	1,565.0
Aspen	47,777.2	--	8,590.3	38,370.1	816.8
Birch	9,303.7	--	--	7,949.1	1,354.6
Boxelder	9,456.7	457.0	1,011.1	6,152.6	1,836.0
Total	506,786.4	55,455.1	126,105.2	271,034.7	54,191.4
All species	509,938.9	55,455.1	126,105.2	274,187.2	54,191.4

[1/] International 1/4-inch rule.

Table 43.--All live tree biomass on commercial forest land by species group and biomass component, North Dakota, 1980

Species group	Biomass component						Biomass component					
			Growing stock		Cull				Growing stock		Cull	
	All components	1- to 5-inch trees	Boles	Tops and limbs	Boles	Tops and limbs	All components	1- to 5-inch trees	Boles	Tops and limbs	Boles	Tops and limbs
	Thousand green tons						Thousand cubic feet					
SOFTWOODS												
Ponderosa pine	71.4	4.4	43.6	19.8	2.5	1.1	3,699.7	431.0	2,122.4	967.5	122.9	55.9
Other softwoods	1.1	1.1	--	--	--	--	104.5	104.5	--	--	--	--
Total	72.5	5.5	43.6	19.8	2.5	1.1	3,804.2	535.5	2,122.4	967.5	122.9	55.9
HARDWOODS												
Oak	2,754.1	610.1	1,063.5	501.0	391.7	187.8	118,080.6	41,896.5	37,734.1	17,786.4	13,941.0	6,722.6
Basswood	498.1	--	268.1	127.2	57.1	45.7	23,996.9	--	12,851.1	6,092.4	2,788.8	2,264.6
Elm	2,183.0	115.2	869.2	424.5	505.7	268.4	90,229.9	8,957.0	34,091.4	16,654.5	19,908.7	10,618.3
Ash	2,706.0	589.3	897.0	429.6	498.6	291.5	140,983.2	49,941.3	38,382.1	18,385.6	21,572.1	12,702.1
Cottonwood	1,430.5	61.9	703.9	337.9	203.0	123.8	58,022.6	4,814.9	27,300.1	13,105.5	7,922.7	4,879.4
Hackberry	20.8	4.0	5.6	2.6	5.3	3.3	979.0	309.1	218.7	102.4	214.3	134.5
Balsam poplar	564.2	94.5	299.8	141.1	16.9	11.9	33,435.9	9,558.0	15,233.7	7,171.2	862.9	610.1
Aspen	3,987.5	940.0	1,535.8	714.2	470.9	326.6	235,297.8	89,313.4	73,300.5	34,089.1	22,738.3	15,856.5
Birch	350.4	47.9	170.0	80.7	33.7	18.1	16,572.6	3,983.6	7,068.0	3,356.5	1,405.4	759.1
Boxelder	1,126.7	198.9	166.6	82.0	436.2	243.0	54,423.8	15,993.3	6,849.8	3,371.5	18,046.0	10,163.2
Other hardwoods	4.2	4.2	--	--	--	--	352.6	352.6	--	--	--	--
Noncommercial species	269.5	54.1	--	--	139.3	76.1	13,667.6	4,501.0	--	--	5,907.9	3,258.7
Total	15,895.0	2,720.1	5,979.5	2,840.8	2,758.4	1,596.2	786,042.5	229,620.7	253,029.5	120,115.1	115,308.1	67,969.1
All species	15,967.5	2,725.6	6,023.1	2,860.6	2,760.9	1,597.3	789,846.7	230,156.2	255,151.9	121,082.6	115,431.0	68,025.0

Table 44.--All live tree biomass on commercial forest land by species group and forest type, North Dakota, 1980

(In thousand green tons)

Species group	All types	Forest type						
		Ponderosa pine	Oak	Elm-ash	Cottonwood	Plains hardwoods	Aspen	Non-stocked
SOFTWOODS								
Ponderosa pine	71.4	71.4	--	--	--	--	--	--
Other softwoods	1.1	1.1	--	--	--	--	--	--
Total	72.5	72.5	--	--	--	--	--	--
HARDWOODS								
Oak	2,754.1	--	1,687.6	410.2	--	263.6	356.4	36.3
Basswood	498.1	--	90.9	46.9	--	360.3	--	--
Elm	2,183.0	--	113.4	1,704.2	57.5	252.8	55.1	--
Ash	2,706.0	5.8	242.3	1,904.4	67.8	66.8	363.2	55.7
Cottonwood	1,430.5	--	--	452.0	960.5	18.0	--	--
Hackberry	20.8	--	--	20.8	--	--	--	--
Balsam poplar	564.2	--	12.3	60.7	--	--	491.2	--
Aspen	3,987.5	--	67.0	116.0	--	11.9	3,787.9	4.7
Birch	350.4	--	54.7	--	3.1	--	292.6	--
Boxelder	1,126.7	--	21.1	948.3	22.7	31.0	57.6	46.0
Other hardwoods	4.2	--	--	4.2	--	--	--	--
Noncommercial species	269.5	--	4.4	207.5	7.6	2.1	47.2	0.7
Total	15,895.0	5.8	2,293.7	5,875.2	1,119.2	1,006.5	5,451.2	143.4
All species	15,967.5	78.3	2,293.7	5,875.2	1,119.2	1,006.5	5,451.2	143.4

Table 45.--All live shrub biomass on commercial forest land by shrub species group and forest type, North Dakota, 1980[1/]

(In green tons)

EAST UNIT

Shrub species group	All types	Forest type						
		Ponderosa pine	Oak	Elm-ash	Cottonwood	Plains hardwoods	Aspen	Non-stocked
TALL SHRUBS								
Boxelder	9,024.0	--	231.2	6,447.6	--	2,081.2	264.0	--
Birch	1,424.4	--	--	--	--	--	1,424.4	--
Dogwood	21,146.8	--	7.2	1,251.6	--	--	19,682.0	206.0
Hawthorn	874.0	--	--	--	--	--	874.0	--
Ash	32,119.6	--	10,461.2	18,286.4	--	125.2	3,246.8	--
Ironwood	16.4	--	--	--	--	16.4	--	--
Aspen	117,548.4	--	2,669.6	53.6	--	--	114,825.2	--
Cherry	105,110.0	--	18,643.2	16,303.2	--	2,812.0	55,195.6	12,156.0
Oak	2,193.6	--	1,671.2	395.6	--	8.8	118.0	--
Hazel	265,505.6	--	21,808.4	7,354.4	--	2,249.6	233,346.8	746.4
Juneberry	155,069.6	--	44,320.8	3,946.4	--	19,943.2	80,514.0	6,345.2
Viburnum	27,664.0	--	13,509.6	2,286.0	--	--	11,868.4	--
Alder buckthorn	89.6	--	--	89.6	--	--	--	--
Sumac	7,025.6	--	7,025.6	--	--	--	--	--
Willow	22,697.2	--	1,049.6	--	--	--	21,647.6	--
Basswood	24.0	--	6.8	6.0	--	11.2	--	--
Elm	15,329.6	--	371.6	8,075.2	--	6,880.4	2.4	--
Total	782,862.4	--	121,776.0	64,495.6	--	34,128.0	543,009.2	19,453.6
LOW SHRUBS:								
Virginia creeper	66.3	--	--	66.3	--	--	--	--
Spirea	96.3	--	--	--	--	--	96.3	--
Ribes	2,396.8	--	89.7	1,008.3	--	82.3	1,129.3	87.2
Chokeberry	48.2	--	48.2	--	--	--	--	--
Rubus	657.4	--	10.5	19.5	--	--	627.4	--
Rosa	8,610.3	--	410.6	1,568.8	--	--	6,630.9	--
Honeysuckle	16,265.5	--	2,423.5	10,063.7	66.8	705.1	2,761.2	245.2
Snowberry	9,975.9	--	2,470.3	698.3	--	450.1	6,223.0	134.2
Poison ivy	3,147.0	--	1,581.6	896.8	--	201.6	385.4	81.6
Grape	1,284.2	--	189.7	923.8	--	84.7	--	86.0
Total	42,547.9	--	7,224.1	15,245.5	66.8	1,523.8	17,853.5	634.2
All shrubs	825,410.3	--	129,000.1	79,741.1	66.8	35,651.8	560,862.7	20,087.8

(Table 45 continued on next page)

[1/] Including trees less than 1 inch in diameter.

(Table 45 continued)

WEST UNIT

Shrub species group	All types	Forest type: Ponderosa pine	Oak	Elm-ash	Cottonwood	Plains hardwoods	Aspen	Non-stocked
TALL SHRUBS								
Boxelder	12,081.2	0.8	1.2	11,952.8	1.6	--	--	124.8
Dogwood	10,429.6	--	--	6,264.8	325.6	--	3,839.2	--
Ash	12,214.8	1,201.2	22.0	7,100.4	536.8	--	2,902.4	452.0
Aspen	4,503.2	--	--	3,788.8	5.2	--	709.2	--
Cherry	19,920.0	2,602.8	406.4	3,019.6	1,706.4	--	12,184.8	--
Oak	161.2	--	161.2	--	--	--	--	--
Hazel	17,687.6	--	14,954.0	--	--	--	2,733.6	--
Juneberry	26,536.4	--	--	3,980.0	3,799.6	--	17,824.0	932.8
Willow	27,938.4	--	--	--	27,938.4	--	--	--
Elm	1,234.0	--	6.8	1,213.2	3.2	--	--	10.8
Total	132,706.4	3,804.8	15,551.6	37,319.6	34,316.8	--	40,193.2	1,520.4
LOW SHRUBS								
Juniper	643.2	643.2	--	--	--	--	--	--
Virginia creeper	242.7	--	--	63.4	179.3	--	--	--
Ribes	679.7	243.8	--	88.0	179.3	--	168.6	--
Rubus	22.4	--	21.4	--	--	--	1.0	--
Rosa	2,055.6	186.2	311.5	185.6	605.6	--	766.7	--
Honeysuckle	10,107.9	374.2	154.3	5,636.2	2,276.0	--	1,311.7	355.5
Vaccinum	36.4	--	--	36.4	--	--	--	--
Poison ivy	1,861.3	--	--	944.9	525.0	--	391.4	--
Grape	87.6	--	--	43.8	43.8	--	--	--
Total	15,736.8	1,447.4	487.2	6,998.3	3,809.0	--	2,639.4	355.5
All shrubs	148,443.2	5,252.2	16,038.8	44,317.9	38,125.8	--	42,832.6	1,875.9
State total	973,853.5	5,252.2	145,038.9	124,059.0	38,192.6	35,651.8	603,695.3	21,963.7

Table 46.--Net annual growth of growing stock on commercial forest land by species group and Forest Survey Unit, North Dakota, 1979

(In thousand cubic feet)

Species group	All units	East Unit	West Unit
SOFTWOODS			
Ponderosa pine	96.5	--	96.5
Total	96.5	--	96.5
HARDWOODS			
Oak	644.1	632.8	11.3
Basswood	307.4	307.4	--
Elm	917.5	865.5	52.0
Ash	738.1	650.4	87.7
Cottonwood	750.2	162.3	587.9
Hackberry	4.6	4.6	--
Balsam poplar	662.2	662.2	--
Aspen	2,993.6	2,858.2	135.4
Birch	360.4	343.7	16.7
Boxelder	202.6	172.1	30.5
Total	7,580.7	6,659.2	921.5
All species	7,677.2	6,659.2	1,018.0

Table 47.--Net annual growth and removals of growing stock and sawtimber on commercial forest land by species group, North Dakota, 1979

Species group	Net annual growth	Annual timber removals
	GROWING STOCK	
	- - - Thousand cubic feet- - -	
SOFTWOODS		
Ponderosa pine	96.5	7.0
Total	96.5	7.0
HARDWOODS		
Oak	644.1	286.0
Basswood	307.4	34.0
Elm	917.5	60.0
Ash	738.0	148.0
Cottonwood	750.2	207.0
Hackberry	4.6	1.0
Balsam poplar	662.2	90.0
Aspen	2993.6	567.0
Birch	360.5	53.0
Boxelder	202.6	45.0
Total	7,580.7	1,491.0
All species	7,677.2	1,498.0
	SAWTIMBER	
	- - -Thousand board feet[1]/- - -	
SOFTWOODS		
Ponderosa pine	87.9	43.0
Total	87.9	43.0
HARDWOODS		
Oak	2,149.6	502.0
Basswood	2,245.3	113.0
Elm	6,904.6	247.0
Ash	2,849.7	220.0
Cottonwood	1,821.8	974.0
Hackberry	12.8	5.0
Balsam poplar	2,158.5	92.0
Aspen	9,860.9	537.0
Birch	1,256.5	80.0
Boxelder	824.9	130.0
Total	30,084.6	2,900.0
All species	30,172.5	2,943.0

[1]/International 1/4-inch rule.

Table 48.--Net annual growth and removals of growing stock and sawtimber on commercial forest land by ownership class and softwoods and hardwoods, North Dakota, 1979

Ownership class	Net annual growth			Annual timber removals		
	All species	Softwoods	Hardwoods	All species	Softwoods	Hardwoods
			GROWING STOCK			
			-Thousand cubic feet-			
PUBLIC						
National Forest	40.5	--	40.5	--	--	--
Misc. federal	167.1	--	167.1	12.0	7.0	5.0
Indian	499.1	--	499.1	48.0	--	48.0
State	641.7	--	641.7	--	--	--
County & municipal	53.0	--	53.0	--	--	--
Total	1,401.4	--	1,401.4	60.0	7.0	53.0
PRIVATE						
Farmer	6,139.2	96.5	6,042.7	1,438.0	--	1,438.0
Misc. private	136.6	--	136.6	--	--	--
Total	6,275.8	96.5	6,179.3	1,438.0	--	1,438.0
All owners	7,677.2	96.5	7,580.7	1,498.0	7.0	1,491.0
			SAWTIMBER			
			Thousand board feet[1]/			
PUBLIC						
National Forest	--	--	--	--	--	--
Misc. federal	726.3	--	726.3	57.0	43.0	14.0
Indian	319.9	--	319.9	140.0	--	140.0
State	7,488.6	--	7,488.6	--	--	--
County & municipal	385.2	--	385.2	--	--	--
Total	8,920.0	--	8,920.0	197.0	43.0	154.0
PRIVATE						
Farmer	20,639.4	87.9	20,551.5	2,746.0	--	2,746.0
Misc. private	613.1	--	613.1	--	--	--
Total	21,252.5	87.9	21,164.6	2,746.0	--	2,746.0
All owners	30,172.5	87.9	30,084.6	2,943.0	43.0	2,900.0

[1]/International 1/4-inch rule.

Table 49.--Timber removals from growing stock and sawtimber on commercial forest land by item and species category, North Dakota, 1979

Item	All species	Softwoods	Elm	Ash	Aspen	Other hardwoods
			Species category			
GROWING STOCK						
	- - - - - - - - - Thousand cubic feet- - - - - - - - -					
ROUNDWOOD PRODUCTS						
Saw logs	117	7	--	--	4	106
Fuelwood	198	--	10	33	48	107
Posts	8	--	--	7	--	1
Total	323	7	10	40	52	214
LOGGING RESIDUE	20	--	--	--	--	20
OTHER REMOVALS	1,155	--	50	108	515	482
TOTAL	1,498	7	60	148	567	716
SAWTIMBER						
	- - - - - - - - - Thousand board feet[1]- - - - - - - - -					
ROUNDWOOD PRODUCTS						
Saw logs	617	43	--	--	15	559
Fuelwood	579	--	31	89	130	329
Posts	1	--	--	1	--	--
Total	1,197	43	31	90	145	888
LOGGING RESIDUE	71	--	--	--	--	71
OTHER REMOVALS	1,675	--	216	130	392	937
TOTAL	2,943	43	247	220	537	1,896

[1]/International 1/4-inch rule.

Table 50.--Annual mortality of growing stock and sawtimber on commercial forest land by species group and Forest Survey Unit, North Dakota, 1979

Species group	All Units		East Unit		West Unit	
	Growing stock	Sawtimber	Growing stock	Sawtimber	Growing stock	Sawtimber
	Thousand cubic feet	Thousand board feet[1]/	Thousand cubic feet	Thousand board feet[1]/	Thousand cubic feet	Thousand board feet[1]/
SOFTWOODS						
Ponderosa pine	0.3	--	--	--	0.3	--
Total	0.3	--	--	--	0.3	--
HARDWOODS						
Oak	54.5	88.5	53.4	88.5	1.1	--
Basswood	31.1	152.8	31.1	152.8	--	--
Elm	103.5	485.8	96.7	456.2	6.8	29.6
Ash	171.9	851.2	152.7	779.5	19.2	71.7
Cottonwood	71.3	360.4	4.7	22.3	66.6	338.1
Hackberry	0.4	1.4	0.4	1.4	--	--
Balsam poplar	209.9	204.6	209.9	204.6	--	--
Aspen	938.4	628.8	910.9	615.2	27.5	13.6
Birch	2.5	3.8	2.3	3.8	0.2	--
Boxelder	9.1	23.8	7.9	22.0	1.2	1.8
Total	1,592.6	2,801.1	1,470.0	2,346.3	122.6	454.8
All species	1,592.9	2,801.1	1,470.0	2,346.3	122.9	454.8

[1]/International 1/4-inch rule.

Table 51.--Annual mortality of growing stock and sawtimber on commercial forest land by species group and cause, North Dakota, 1979

Species group	All causes	Cause				
		Disease	Fire	Animals	Weather	Unknown and other
GROWING STOCK						
				Thousand cubic feet		
SOFTWOODS						
Ponderosa pine	0.3	--	--	--	--	0.3
Total	0.3	--	--	--	--	0.3
HARDWOODS						
Oak	54.5	--	--	--	--	54.5
Basswood	31.1	--	--	--	--	31.1
Elm	103.5	--	--	59.5	--	44.0
Ash	171.9	35.4	--	59.7	47.7	29.1
Cottonwood	71.3	--	--	--	--	71.3
Hackberry	0.4	--	--	--	--	0.4
Balsam poplar	209.9	--	--	--	209.9	--
Aspen	938.4	652.7	--	--	158.7	127.0
Birch	2.5	--	--	--	--	2.5
Boxelder	9.1	9.1	--	--	--	--
Total	1,592.6	697.2	--	119.2	416.3	359.9
All species	1,592.9	697.2	--	119.2	416.3	360.2
SAWTIMBER						
				Thousand board feet[1/]		
SOFTWOODS						
Ponderosa pine	--	--	--	--	--	--
Total	--	--	--	--	--	--
HARDWOODS						
Oak	88.5	--	--	--	--	88.5
Basswood	152.8	--	--	--	--	152.8
Elm	485.8	--	--	485.8	--	--
Ash	851.2	320.0	--	282.8	--	248.4
Cottonwood	360.4	--	--	--	--	360.4
Hackberry	1.4	--	--	--	--	1.4
Balsam poplar	204.6	--	--	--	204.6	--
Aspen	628.8	499.7	--	--	129.1	--
Birch	3.8	--	--	--	--	3.8
Boxelder	23.8	23.8	--	--	--	--
Total	2,801.1	843.5	--	768.6	333.7	855.3
All species	2,801.1	843.5	--	768.6	333.7	855.3

[1/] International 1/4-inch rule.

Table 52.--Annual mortality of growing stock and sawtimber on commercial forest land by ownership class and softwoods and hardwoods, North Dakota, 1979

Ownership class	All species	Softwoods	Hardwoods
	GROWING STOCK		
	- - - - Thousand cubic feet- - - -		
National Forest	2.9	--	2.9
Miscellaneous federal	37.4	--	37.4
Indian	141.1	--	141.1
State	207.2	--	207.2
County & municipal	1.2	--	1.2
Forest industry	--	--	--
Farmer	1,171.3	0.3	1,169.9
Misc. priv.-indiv.	31.8	--	31.8
All owners	1,592.9	0.3	1,592.6
	SAWTIMBER		
	- - - - Thousand board feet[1]- - - -		
National Forest	--	--	--
Miscellaneous federal	48.3	--	48.3
Indian	61.9	--	61.9
State	188.8	--	188.8
County & municipal	2.6	--	2.6
Forest industry	--	--	--
Farmer	2,466.1	--	2,466.1
Misc. priv.-indiv.	33.4	--	33.4
All owners	2,801.1	--	2,801.1

[1] International 1/4-inch rule.

Table 53.--Output of timber products by product, softwoods and hardwoods, and source of material, North Dakota, 1977

Product and softwoods and hardwoods	Standard units	Total		Roundwood products				Plant byproducts	
				Growing stock		Nongrowing stock			
		No. of units	Thousand cubic feet	No. of units	Thousand cubic feet	No. of units	Thousand cubic feet	No. of units	Thousand cubic feet
SAW LOGS									
Softwood	[1]/Thousand	44	7	44	7	--	--	--	--
Hardwood	board feet	646	112	634	110	12	2	--	--
Total		690	119	678	117	12	2	--	--
FUELWOOD									
Softwood	[2]/Standard	31	2	1	[3]/	2	[3]/	28	2
Hardwood	cords	7,047	442	3,170	198	3,634	227	243	17
Total		7,078	444	3,171	198	3,636	227	271	19
POSTS									
Softwood	Thousand	--	--	--	--	--	--	--	--
Hardwood	pieces	38	16	19	8	19	8	--	--
Total		38	16	19	8	19	8	--	--
ALL PRODUCTS									
Softwood	Thousand	75	9	45	7	2	--	28	2
Hardwood	cubic feet	7,731	570	3,823	316	3,665	237	243	17
Total		7,806	579	3,868	323	3,667	237	271	19

[1]/International 1/4-inch rule.
[2]/Rough-wood, 128 cubic-foot basis.
[3]/Less than 500 cubic feet.

Table 54.--Output of roundwood products by product, softwoods and hardwoods, and source of material, North Dakota, 1977

(In thousand cubic feet)

Product and softwoods and hardwoods	All sources	Growing-stock trees			Rough and rotten trees	Salvable dead trees	Other sources
		Total	Sawtimber	Poletimber			
INDUSTRIAL PRODUCTS							
Saw logs							
Softwood	7	7	7	--	--	--	--
Hardwood	112	110	102	8	--	--	2
Subtotal	119	117	109	8	--	--	2
Posts (Round and split)							
Softwood	--	--	--	--	--	--	--
Hardwood	16	8	--	8	--	--	8
Subtotal	16	8	--	8	--	--	8
All industrial products							
Softwood	7	7	7	--	--	--	--
Hardwood	128	118	102	16	--	--	10
Total	135	125	109	16	--	--	10
FUELWOOD							
Softwood	--	--	--	--	--	--	--
Hardwood	425	198	106	92	95	2	130
Total	425	198	106	92	95	2	130
ALL PRODUCTS							
Softwood	7	7	7	--	--	--	--
Hardwood	553	316	208	108	95	2	140
Total	560	323	215	108	95	2	140

Table 55.--Volume of primary plant residue by type of use and kind of material, North Dakota, 1977

(In thousand cubic feet)

Type of use	Kind of wood residue							
	Total		Coarse[1/]		Fine[2/]		Bark	
	Softwood	Hardwood	Softwood	Hardwood	Softwood	Hardwood	Softwood	Hardwood
Industrial fuel	--	3.1	--	3.1	--	--	--	--
Domestic fuel	1.7	13.8	1.7	12.4	--	1.4	1.1	8.0
Miscellaneous[3/]	--	12.0	--	0.5	--	11.5	--	--
Not used[4/]	1.6	20.3	0.4	15.0	1.2	5.3	0.3	12.1
Total	3.3	49.2	2.1	31.0	1.2	18.2	1.4	20.1

1/Suitable for chipping such as slabs, edgings, veneer cores, etc.
2/Not suitable for chipping such as sawdust, veneer clippings, etc.
3/Livestock bedding, mulch, small dimension, and specialty items.
4/Includes residue burned as waste.

Table 56.--Removals[1], net annual growth, and inventory of growing stock on 1980, and low removals option projections[2] to 2010

(In million cubic feet)

Year	All species		
	Removals	Growth	Inventory
1980	1.5	8.8	207.0
1990	2.1	11.6	293.8
2000	2.9	12.1	387.5
2010	4.4	12.6	476.2

[1] The volume of timber removals includes volume "lost" due to land clearing, flooding, thinning, or changes in land use, in addition to timber cut and used.

[2] Based on the following assumptions: (a) the overall removals rate will be lower than that for the high removals option; (b) the annual removals rates will differ for each product, but the average annual removals rate will be 0.9 percent; (c) the total area of commercial forest land will continue to decline; (d) radial growth will decline over time in relation to the increase of basal area per acre of trees; (e) the intensity of forest management will continue at the rate indicated by recent trends; (f) the volume of "other" removals will drop during the period as more of these trees are utilized and the decline in commercial forest area stabilizes.

Table 57.--Removals[1], net annual growth, and inventory of growing stock on commercial forest land, North Dakota, 1980, and high removals option projections[2] to 2010

(In million cubic feet)

Year	All species		
	Removals	Growth	Inventory
1980	1.6	8.7	207.0
1990	2.4	11.5	292.7
2000	4.2	11.9	378.9
2010	10.0	12.0	435.6

[1] The volume of timber removals includes volume "lost" due to land clearing, flooding, thinning, or changes in land use, in addition to timber cut and used.

[2] Based on the following assumptions: (a) the overall removals rate will be higher than that for the low removals option; (b) the annual removals rates will differ for each product, but the average annual removals rate will be 1.8 percent; (c) the total area of commercial forest land will continue to decline; (d) radial growth will decline over time in relation to the increase of basal area per acre of trees; (e) the intensity of forest management will continue at the rate indicated by recent trends; (f) the volume of "other" removals will drop during the period as more of these trees are utilized and the decline in commercial forest area stabilizes.

Table 58.--Timber volume targeted for removal on commercial forest land qualifying for treatment by species group, tree class, and treatment, North Dakota, 1980-1990

(In thousand cubic feet)

Species group[1/]	All classes	Tree class: Growing stock: Poletimber	Tree class: Growing stock: Sawtimber	Tree class: Cull: Short-log	Tree class: Cull: Other	Salvable dead
HARVEST						
HARDWOODS						
Oak	12,146.8	3,643.0	6,202.4	622.8	1,372.1	306.5
Basswood	4,446.2	213.4	3,582.3	127.1	523.4	--
Elm	20,084.6	1,826.0	15,329.5	1,169.0	1,439.9	320.2
Ash	18,262.3	4,464.0	7,440.9	996.2	4,855.0	506.2
Eastern cottonwood	6,923.4	--	5,588.5	657.1	658.3	19.5
Hackberry	230.8	85.4	99.7	39.1	6.6	--
Balsam poplar	9,742.0	6,212.5	3,380.8	--	100.5	48.2
Aspen	59,686.5	34,753.2	16,332.1	212.8	7,310.6	1,077.8
Birch	5,986.6	2,743.3	2,703.7	232.1	245.6	61.9
Boxelder	3,875.1	1,224.3	1,080.5	122.2	1,351.9	96.2
Other hardwoods[2/]	--	--	--	--	--	--
Noncommercial species	1,288.4	--	--	--	386.3	902.1
Total	142,672.7	55,165.1	61,740.4	4,178.4	18,250.2	3,338.6
THIN						
HARDWOODS						
Oak	86.8	--	--	--	86.8	--
Basswood	--	--	--	--	--	--
Elm	765.8	304.8	328.0	122.9	10.1	--
Ash	635.5	256.8	--	99.1	279.6	--
Eastern cottonwood	2,360.7	2,086.1	--	--	274.6	--
Hackberry	--	--	--	--	--	--
Balsam poplar	--	--	--	--	--	--
Aspen	57.6	--	--	--	57.6	--
Birch	--	--	--	--	--	--
Boxelder	216.4	--	--	--	216.4	--
Other hardwoods[2/]	--	--	--	--	--	--
Noncommercial species	9.3	--	--	--	9.3	--
Total	4,132.1	2,647.7	328.0	222.0	934.4	--
STAND CONVERSION OR RESTOCKING						
HARDWOODS						
Oak	880.7	191.0	529.6	--	160.1	--
Basswood	--	--	--	--	--	--
Elm	3,269.5	--	2,879.5	208.8	139.6	41.6
Ash	1,900.0	520.6	654.7	--	558.6	166.1
Eastern cottonwood	--	--	--	--	--	--
Hackberry	--	--	--	--	--	--
Balsam poplar	1,030.1	1,030.1	--	--	--	--
Aspen	516.3	273.1	--	--	243.2	--
Birch	--	--	--	--	--	--
Boxelder	446.3	154.0	61.1	96.4	129.7	5.1
Other hardwoods[2/]	7,081.4	--	5,618.6	1,310.3	152.5	--
Noncommercial species	--	--	--	--	--	--
Total	15,124.3	2,168.8	9,743.5	1,615.5	1,383.7	212.8

[1/] No softwood volume was targeted for removal.

[2/] Predominately plains cottonwood.

Table 59.--Growing-stock volume targeted for removal on commercial forest land qualifying for treatment by species group, forest type, and treatment, North Dakota, 1980-1990

(In thousand cubic feet)

Species group[1]	All types	Forest type				
		Oak	Elm-ash	Cottonwood	Plains hardwoods	Aspen
HARVEST						
HARDWOODS						
Oak	9,845.4	2,087.6	3,354.7	--	1,766.5	2,636.6
Basswood	4,611.7	--	527.8	--	3,267.9	816.0
Elm	18,690.5	704.5	13,391.9	186.4	2,056.7	2,351.0
Ash	9,554.0	321.5	8,880.1	49.1	303.3	--
Eastern cottonwood	5,588.5	--	1,896.4	3,692.1	--	--
Hackberry	185.1	--	185.1	--	--	--
Balsam poplar	9,593.3	--	394.0	--	--	9,199.3
Aspen	51,085.2	--	970.3	--	--	50,114.9
Birch	5,446.9	--	--	--	--	5,446.9
Boxelder	2,304.8	--	1,601.4	187.2	194.3	321.9
Other hardwoods[2]	--	--	--	--	--	--
Noncommercial species	--	--	--	--	--	--
Total	116,905.4	3,113.6	31,201.7	4,114.8	7,588.7	70,886.6
THIN						
HARDWOODS						
Oak	--	--	--	--	--	--
Basswood	--	--	--	--	--	--
Elm	632.9	--	632.9	--	--	--
Ash	256.8	--	256.8	--	--	--
Eastern cottonwood	2,086.1	--	--	2,086.1	--	--
Hackberry	--	--	--	--	--	--
Balsam poplar	--	--	--	--	--	--
Aspen	--	--	--	--	--	--
Birch	--	--	--	--	--	--
Boxelder	--	--	--	--	--	--
Other hardwoods[2]	--	--	--	--	--	--
Noncommercial species	--	--	--	--	--	--
Total	2,975.8	--	889.7	2,086.1	--	--
STAND CONVERSION OR RESTOCKING						
HARDWOODS						
Oak	720.6	--	720.6	--	--	--
Basswood	--	--	--	--	--	--
Elm	2,879.5	--	2,879.5	--	--	--
Ash	1,175.3	--	1,175.3	--	--	--
Eastern cottonwood	--	--	--	--	--	--
Hackberry	--	--	--	--	--	--
Balsam poplar	1,030.1	--	--	--	--	1,030.1
Aspen	273.1	--	--	--	--	273.1
Birch	--	--	--	--	--	--
Boxelder	215.1	--	119.9	--	--	95.2
Other hardwoods[2]	5,618.6	--	--	5,618.6	--	--
Noncommercial species	--	--	--	--	--	--
Total	11,912.3	--	4,895.3	5,618.6	--	1,398.4

[1]/No softwood was targeted for removal.

[2]/Predominately plains cottonwood.

Table 60.--Area of commercial forest land qualifying for treatment by forest type, stand-age class, and treatment class, North Dakota, 1980-1990

(In thousand acres)

Forest type[1/]	All classes	Stand-age class (years)												
		1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	101-120	121-140	141+
HARVEST														
Ponderosa pine	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Oak	1.7	--	--	--	--	--	--	--	--	--	1.7	--	--	--
Elm-ash	49.4	--	--	--	--	--	--	--	11.3	11.3	6.9	15.3	4.6	--
Cottonwood	5.1	--	--	--	--	--	--	--	--	3.3	--	1.8	--	--
Plains hardwoods	7.3	--	--	--	--	--	--	--	--	--	5.0	2.3	--	--
Aspen	71.9	--	--	--	--	47.1	14.6	5.0	5.2	--	--	--	--	--
All types	135.4	--	--	--	--	47.1	14.6	5.0	16.5	14.6	13.6	19.4	4.6	--
THIN														
Ponderosa pine	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Oak	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Elm-ash	9.9	2.3	1.7	--	2.5	3.4	--	--	--	--	--	--	--	--
Cottonwood	3.0	--	--	--	3.0	--	--	--	--	--	--	--	--	--
Plains hardwoods	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aspen	--	--	--	--	--	--	--	--	--	--	--	--	--	--
All types	12.9	2.3	1.7	--	5.5	3.4	--	--	--	--	--	--	--	--
STAND CONVERSION OR RESTOCKING														
Ponderosa pine	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Oak	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Elm-ash	17.2	3.4	2.5	--	--	--	1.7	--	--	1.7	1.7	4.6	1.6	--
Cottonwood	3.4	--	--	--	--	--	--	--	--	--	--	3.4	--	--
Plains hardwoods	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aspen	7.1	7.1	--	--	--	--	--	--	--	--	--	--	--	--
All types	27.7	10.5	2.5	--	--	--	1.7	--	--	1.7	1.7	8.0	1.6	--
NO TREATMENT														
Ponderosa pine	2.1	--	--	--	--	--	--	2.1	--	--	--	--	--	--
Oak	42.5	2.3	2.3	--	3.4	7.8	16.2	3.4	4.5	2.6	--	--	--	--
Elm-ash	46.4	19.4	9.7	--	--	1.9	4.9	10.5	--	--	--	--	--	--
Cottonwood	7.2	2.5	2.4	--	--	2.3	--	--	--	--	--	--	--	--
Plains hardwoods	8.5	--	--	--	--	--	--	2.3	1.6	4.6	--	--	--	--
Aspen	60.5	21.7	12.5	6.1	20.2	--	--	--	--	--	--	--	--	--
All types	167.2	45.9	26.9	6.1	23.6	12.0	21.1	18.3	6.1	7.2	--	--	--	--

[1/] The 9,200 acres of nonstocked commercial forest land is included in the cottonwood forest type.

Table 61.--Growing-stock volume targeted for removal on commercial forest land qualifying for treatment by forest type, stand-age class, and treatment class, North Dakota, 1980-1990

(In thousand cubic feet)

Forest type[1/]	All classes	Stand-age class (years)												
		1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	101-120	121-140	141+
HARVEST														
Oak	3,113.6	--	--	--	--	--	--	--	--	--	3,113.6	--	--	--
Elm-ash	31,201.6	--	--	--	--	--	--	--	5,076.6	9,198.4	3,774.7	10,920.7	2,231.2	--
Cottonwood	4,114.7	--	--	--	--	--	--	--	--	2,823.9	--	1,290.8	--	--
Plains hardwoods	7,588.7	--	--	--	--	--	--	--	--	--	6,578.9	1,009.8	--	--
Aspen	70,886.7	--	--	--	--	46,878.8	14,279.1	4,603.2	5,125.6	--	--	--	--	--
All types	116,905.4	--	--	--	--	46,878.8	14,279.1	4,603.2	10,202.2	12,022.4	13,467.2	13,221.3	2,231.2	--
THIN														
Oak	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Elm-ash	889.6	--	--	--	889.6	--	--	--	--	--	--	--	--	--
Cottonwood	2,086.1	--	--	--	2,086.1	--	--	--	--	--	--	--	--	--
Plains hardwoods	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aspen	--	--	--	--	--	--	--	--	--	--	--	--	--	--
All types	2,975.7	--	--	--	2,975.7	--	--	--	--	--	--	--	--	--
STAND CONVERSION OR RESTOCKING														
Oak	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Elm-ash	4,895.4	--	103.5	--	--	--	219.3	--	--	368.7	739.6	2,278.5	1,185.8	--
Cottonwood	5,618.6	--	--	--	--	--	--	--	--	--	--	5,618.6	--	--
Plains hardwoods	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aspen	1,398.4	1,398.4	--	--	--	--	--	--	--	--	--	--	--	--
All types	11,912.4	1,398.4	103.5	--	--	--	219.3	--	--	368.7	739.6	7,897.1	1,185.8	--

1/Volume on the 9,200 acres of nonstocked commercial forest land is included in the cottonwood forest type.

Table 62.--Area of commercial forest land qualifying for treatment by forest type, site-index class, and treatment class, North Dakota, 1980-1990

(In thousand acres)

Forest type[1/]	All classes	Site-index class (feet)								
		11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91+
HARVEST										
Ponderosa pine	--	--	--	--	--	--	--	--	--	--
Oak	1.7	--	--	--	--	1.7	--	--	--	--
Elm-ash	49.4	--	--	11.9	19.3	16.4	1.8	--	--	--
Cottonwood	5.1	--	--	1.7	1.7	--	1.7	--	--	--
Plains hardwoods	7.3	--	--	5.6	--	--	1.7	--	--	--
Aspen	71.9	--	--	1.7	2.5	32.1	30.4	5.2	--	--
All types	135.4	--	--	20.9	23.5	50.2	35.6	5.2	--	--
THIN										
Ponderosa pine	--	--	--	--	--	--	--	--	--	--
Oak	--	--	--	--	--	--	--	--	--	--
Elm-ash	9.9	--	--	1.7	4.2	--	4.0	--	--	--
Cottonwood	3.0	--	--	--	--	--	--	--	3.0	--
Plains hardwoods	--	--	--	--	--	--	--	--	--	--
Aspen	--	--	--	--	--	--	--	--	--	--
All types	12.9	--	--	1.7	4.2	--	4.0	--	3.0	--
STAND CONVERSION OR RESTOCKING										
Ponderosa pine	--	--	--	--	--	--	--	--	--	--
Oak	--	--	--	--	--	--	--	--	--	--
Elm-ash	17.2	--	--	11.6	3.3	2.3	--	--	--	--
Cottonwood	3.4	--	--	--	--	--	--	--	--	3.4
Plains hardwoods	--	--	--	--	--	--	--	--	--	--
Aspen	7.1	--	--	--	4.6	--	2.5	--	--	--
All types	27.7	--	--	11.6	7.9	2.3	2.5	--	--	3.4
NO TREATMENT										
Ponderosa pine	2.1	--	--	2.1	--	--	--	--	--	--
Oak	42.5	--	7.6	2.8	17.5	12.3	2.3	--	--	--
Elm-ash	46.4	--	--	10.8	11.9	5.7	12.3	4.0	1.7	--
Cottonwood	7.2	--	--	2.5	2.4	--	--	2.3	--	--
Plains hardwoods	8.5	--	--	--	4.5	2.3	1.7	--	--	--
Aspen	60.5	--	--	14.0	8.8	12.7	19.1	5.9	--	--
All types	167.2	--	7.6	32.2	45.1	33.0	35.4	12.2	1.7	--

[1/] The 9,200 acres of nonstocked commercial forest land is included in the cottonwood forest type.

Table 63.--Growing-stock volume targeted for removal on commercial forest land qualifying for treatment by forest type, site-index class, and treatment class, North Dakota, 1980-1990

(In thousand cubic feet)

Forest type[1/]	All classes	Site-index class (feet)								
		11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	90+
HARVEST										
Oak	3,113.6	--	--	--	--	3,113.6	--	--	--	--
Elm-ash	31,201.8	--	--	5,658.0	10,010.2	12,383.4	3,150.2	--	--	--
Cottonwood	4,114.7	--	--	1,492.9	1,331.0	--	1,290.8	--	--	--
Plains hardwoods	7,588.7	--	--	3,986.0	--	--	3,602.7	--	--	--
Aspen	70,886.8	--	--	481.9	2,415.2	29,506.2	31,095.3	7,388.2	--	--
All types	116,905.6	--	--	11,618.8	13,756.4	45,003.2	39,139.0	7,388.2	--	--
THIN										
Oak	--	--	--	--	--	--	--	--	--	--
Elm-ash	889.6	--	--	--	889.6	--	--	--	--	--
Cottonwood	2,086.1	--	--	--	--	--	--	--	2,086.1	--
Plains hardwoods	--	--	--	--	--	--	--	--	--	--
Aspen	--	--	--	--	--	--	--	--	--	--
All types	2,975.7	--	--	--	889.6	--	--	--	2,086.1	--
STAND CONVERSION OR RESTOCKING										
Oak	--	--	--	--	--	--	--	--	--	--
Elm-ash	4,895.4	--	--	1,721.3	1,554.5	1,619.6	--	--	--	--
Cottonwood	5,618.6	--	--	--	--	--	--	--	--	5,618.6
Plains hardwoods	--	--	--	--	--	--	--	--	--	--
Aspen	1,398.6	--	--	--	368.3	--	1,030.3	--	--	--
All types	11,912.6	--	--	1,721.3	1,922.8	1,619.6	1,030.3	--	--	5,618.6

[1/] Volume on the 9,200 acres of nonstocked commercial forest land is included in the cottonwood forest type.

Table 64.--Empirical yields from average sites by forest type and stand-age class, North Dakota, 1980

(In cubic feet per acre)

Forest type	Average all ages	Stand-age class (years)												
		1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	101-120	121-140	141+
Ponderosa pine	806.8	--	--	--	--	--	--	806.8	--	--	--	--	--	--
Oak	596.6	158.6	317.8	--	304.9	346.9	565.9	1,598.3	495.8	465.3	2,051.1	--	--	--
Elm-ash	576.6	299.8	50.6	--	1,268.0	524.3	291.9	894.3	525.2	922.2	663.6	764.0	704.6	--
Cottonwood	896.2	30.9	108.3	--	1,232.9	837.4	--	--	--	994.6	--	1,445.3	--	--
Plains hardwoods	1,053.9	--	--	--	--	--	--	255.8	2,053.9	817.8	1,524.9	604.5	--	--
Aspen	573.6	137.5	151.8	235.0	625.5	779.2	942.6	1,025.8	865.3	--	--	--	--	--
Nonstocked	7.8	--	--	--	--	42.1	--	--	--	--	--	--	--	--
Average all types	603.5	164.9	115.5	235.0	705.8	692.6	664.6	954.3	705.8	861.4	1,099.2	879.9	704.6	--

Table 65.--Sampling errors[1/] for estimates other than State totals of volume, net growth, and removals and of area of commercial forest land in North Dakota, 1980

Sampling error	Commercial forest area	Growing stock			Sawtimber		
		Inventory	Growth	Removals	Inventory	Growth	Removals
Percent	Thousand acres	- - -Million cubic feet- - -			- -[2/]Million board feet - - -		
1	15,104.4	13,831.8	738.0	1110.7	70,255.0	7,345.7	1898.7
2	3,776.1	3,458.0	184.5	277.7	17,563.8	1,836.4	474.7
3	1,678.3	1,536.9	82.0	123.4	7,806.1	816.2	211.0
4	944.0	864.5	46.1	69.4	4,390.9	459.1	118.7
5	604.2	553.3	29.5	44.4	2,810.2	293.8	75.9
10	151.0	138.3	7.4	11.1	702.6	73.5	19.0
15	67.1	61.5	3.3	4.9	312.2	32.6	8.4
20	37.8	34.6	1.8	2.8	175.6	18.4	4.7
25	24.2	22.1	1.2	1.8	112.4	11.8	3.0
50	6.0	5.5	0.3	0.4	28.1	2.9	0.8
100	1.5	1.4	0.1	0.1	7.0	0.7	0.2

[1/]At the 68-percent probability level.
[2/]International 1/4-inch rule.

Table 66.--Area by land class and Forest Survey Unit, North Dakota, 1980

(In thousand hectares)

Land class	All units	East Unit	West Unit
FOREST LAND			
Commercial	139.0	114.9	24.1
Noncommercial	89.5	19.9	69.6
Total	228.5	134.8	93.7
NONFOREST LAND			
Nonforest with trees	367.6	124.2	243.4
Nonforest without trees	17,345.2	8,734.4	8,610.8
Total	17,712.8	8,858.6	8,854.2
TOTAL LAND AREA[1/]	17,941.3	8,993.4	8,947.9

[1/]U.S. Department of Commerce, Bureau of the Census. 1970. Area Measurement reports, GE 20, No. 1, 22 p.

Table 67.--Area of commercial forest land by forest type and stand-age class, North Dakota, 1980

(In thousand hectares)

Forest type	All classes	Stand-age class (years)												
		1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	101-120	121-140	141+
Ponderosa pine	0.9	--	--	--	--	--	--	0.9	--	--	--	--	--	--
Oak	17.9	0.9	0.9	--	1.4	3.2	6.6	1.3	1.8	1.1	0.7	--	--	--
Elm-ash	46.0	7.1	5.7	--	1.0	1.5	2.6	4.3	4.6	5.1	3.5	8.1	2.5	--
Cottonwood	7.6	1.0	1.0	--	1.2	0.9	--	--	--	1.4	--	2.1	--	--
Maple-basswood	6.4	--	--	--	--	--	--	0.9	0.7	1.9	2.0	0.9	--	--
Aspen-birch	56.5	11.8	5.0	2.5	8.2	19.0	5.9	2.0	2.1	--	--	--	--	--
Nonstocked	3.7	3.0	--	--	--	0.7	--	--	--	--	--	--	--	--
All types	139.0	23.8	12.6	2.5	11.8	25.3	15.1	9.4	9.2	9.5	6.2	11.1	2.5	--

Table 68.--Net volume of growing stock on commercial forest land by forest type and stand-age class, North Dakota, 1980

(In thousand cubic meters)

Forest type	All classes	Stand-age class (years)												
		1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	101-120	121-140	141+
Ponderosa pine	47.9	--	--	--	--	--	--	47.9	--	--	--	--	--	--
Oak	746.2	10.3	20.7	--	29.3	76.6	259.5	153.8	63.1	34.2	98.7	--	--	--
Elm-ash	1,855.3	149.3	19.9	--	89.7	53.4	54.5	265.8	168.0	339.3	161.5	430.3	123.6	--
Cottonwood	474.3	2.2	7.4	--	104.7	54.5	--	--	--	92.9	--	212.6	--	--
Maple-basswood	471.2	--	--	--	--	--	--	16.6	93.0	106.5	215.8	39.3	--	--
Aspen-birch	2,264.3	112.0	53.7	40.6	357.6	1,038.6	389.4	145.1	127.3	--	--	--	--	--
Nonstocked	2.0	--	--	--	--	2.0	--	--	--	--	--	--	--	--
All types	5,861.2	273.8	101.7	40.6	581.3	1,225.1	703.4	629.2	451.4	572.9	476.0	682.2	123.6	--

Table 69.--Net volume of growing stock on commercial forest land by species group and forest type, North Dakota, 1980

(In thousand cubic meters)

Species group	All types	Forest type						
		Ponderosa pine	Oak	Elm-ash	Cottonwood	Maple-basswood	Aspen-birch	Non-stocked
SOFTWOODS								
Ponderosa pine	47.9	47.9	--	--	--	--	--	--
Total	47.9	47.9	--	--	--	--	--	--
HARDWOODS								
Oak	827.2	--	489.2	154.8	--	107.5	75.7	--
Basswood	286.4	--	65.7	19.8	--	200.9	--	--
Elm	794.1	--	37.8	612.8	5.6	114.3	23.6	--
Ash	881.8	--	91.2	662.0	2.2	34.3	90.1	2.0
Cottonwood	662.2	--	--	202.8	459.4	--	--	--
Hackberry	5.1	--	--	5.1	--	--	--	--
Balsam poplar	339.8	--	4.7	47.3	--	--	287.8	--
Aspen	1,695.5	--	27.5	26.4	--	6.4	1,635.2	--
Birch	170.9	--	30.2	--	--	--	140.7	--
Boxelder	150.6	--	--	124.4	7.1	7.8	11.3	--
Total	5,813.6	--	746.3	1,855.4	474.3	471.2	2,264.4	2.0
All species	5,861.5	47.9	746.3	1,855.4	474.3	471.2	2,264.4	2.0

Table 70.--All live biomass by species and component,
North Dakota, 1980

Species group	Biomass component						Biomass component					
			Growing stock		Cull				Growing stock		Cull	
	All components	1- to 5-inch trees	Boles	Tops and limbs	Boles	Tops and limbs	All components	1- to 5-inch trees	Boles	Tops and limbs	Boles	Tops and limbs
	Thousand green metric tons						Thousand cubic meters					
SOFTWOODS												
Ponderosa pine	78.5	4.8	47.9	21.8	2.8	1.2	104.7	12.2	60.0	27.4	3.5	1.6
Other softwoods	1.2	1.2	--	--	--	--	3.0	3.0	--	--	--	--
Total	79.7	6.0	47.9	21.8	2.8	1.2	107.7	15.2	60.0	27.4	3.5	1.6
HARDWOODS												
Oak	3,029.5	671.1	1,169.9	551.1	430.9	206.5	3,341.7	1,185.7	1,067.9	503.4	394.5	190.2
Basswood	547.9	--	294.9	139.9	62.8	50.3	679.1	--	363.7	172.4	78.9	64.1
Elm	2,401.3	126.7	956.1	467.0	556.3	295.2	2,553.5	253.5	964.8	471.3	563.4	300.5
Ash	2,976.6	648.2	986.7	472.6	548.4	320.7	3,989.8	1,413.3	1,086.2	520.3	610.5	359.5
Cottonwood	1,573.6	68.1	774.3	371.7	223.3	136.2	1,642.0	136.3	772.5	370.9	224.2	138.1
Hackberry	22.9	4.4	6.2	2.9	5.8	3.6	27.7	8.7	6.2	2.9	6.1	3.8
Balsam poplar	620.6	104.0	329.8	155.2	18.5	13.1	946.2	270.5	431.1	202.9	24.4	17.3
Aspen	4,386.3	1,034.0	1,689.4	785.6	518.0	359.3	6,659.0	2,527.6	2,074.4	964.8	643.5	448.7
Birch	385.4	52.7	187.0	88.7	37.1	19.9	469.0	112.7	200.0	95.0	39.8	21.5
Boxelder	1,239.4	218.8	183.3	90.2	479.8	267.3	1,540.2	452.6	193.9	95.4	510.7	287.6
Other hardwoods	4.6	4.6	--	--	--	--	10.0	10.0	--	--	--	--
Noncommercial species	296.5	59.5	--	--	153.3	83.7	386.8	127.4	--	--	167.2	92.2
Total	17,484.6	2,992.1	6,577.6	3,124.9	3,034.2	1,755.8	22,245.0	6,498.3	7,160.7	3,399.3	3,263.2	1,923.5
All species	17,564.3	2,998.1	6,625.5	3,146.7	3,037.0	1,757.0	22,352.7	6,513.5	7,220.7	3,426.7	3,266.7	1,925.1

Table 71.--All live biomass on commercial forest land by shrub species group and forest type, North Dakota, 1980

(In green metric tons)

EAST UNIT

Shrub species group	All types	Forest type						
		Ponderosa pine	Oak	Elm-ash	Cottonwood	Plains hardwoods	Aspen	Non-stocked
TALL SHRUBS								
Boxelder	8,203.6	--	210.4	5,861.2	--	1,892.0	240.0	--
Birch	1,294.8	--	--	--	--	--	1,294.8	--
Dogwood	19,224.4	--	6.8	1,137.6	--	--	17,892.8	187.2
Hawthorn	794.4	--	--	--	--	--	794.4	--
Ash	29,199.6	--	9,510.4	16,624.0	--	113.6	2,951.6	--
Ironwood	14.8	--	--	--	--	14.8	--	--
Aspen	106,862.0	--	2,426.8	48.8	--	--	104,386.4	--
Cherry	95,554.4	--	16,948.4	14,821.2	--	2,556.4	50,177.6	11,050.8
Oak	1,994.0	--	1,519.2	359.6	--	8.0	107.2	--
Juneberry	241,368.8	--	19,826.0	6,685.6	--	2,045.2	212,133.6	678.4
Viburnum	140,972.0	--	40,291.6	3,587.6	--	18,130.0	73,194.4	5,768.4
Hazel	25,149.2	--	12,281.6	2,078.0	--	--	10,789.6	--
Alder buckthorn	81.6	--	--	81.6	--	--	--	--
Sumac	6,386.8	--	6,386.8	--	--	--	--	--
Willow	20,634.0	--	954.4	--	--	--	19,679.6	--
Basswood	22.4	--	6.4	5.6	--	10.4	--	--
Elm	13,936.4	--	338.0	7,341.2	--	6,254.8	2.4	--
Total	711,693.2	--	110,706.8	58,632.0	--	31,025.2	493,644.4	17,684.8
LOW SHRUBS								
Virginia creeper	60.3	--	--	60.3	--	--	--	--
Spirea	87.5	--	--	--	--	--	87.5	--
Ribes	2,178.9	--	81.6	916.6	--	74.8	1,026.6	79.3
Chokeberry	43.9	--	43.9	--	--	--	--	--
Rubus	597.6	--	9.5	17.7	--	--	570.4	--
Rosa	7,827.5	--	373.2	1,426.2	--	--	6,028.1	--
Honeysuckle	14,786.8	--	2,203.2	9,148.8	60.7	641.0	2,510.2	222.9
Snowberry	9,069.1	--	2,245.8	634.8	--	409.2	5,657.3	122.0
Poison Ivy	2,860.8	--	1,437.8	815.3	--	183.2	350.3	74.2
Grape	1,167.3	--	172.4	839.8	--	77.0	--	78.1
Total	38,679.7	--	6,567.4	13,859.5	60.7	1,385.2	16,230.4	576.5
All shrubs	750,372.9	--	117,274.2	72,491.5	60.7	32,410.4	509,874.8	18,261.3

(Table 71 continued on next page)

(Table 71 continued)

WEST UNIT

Shrub Species group	All types	Forest type: Ponderosa pine	Oak	Elm-ash	Cottonwood	Plains hardwoods	Aspen	Non-stocked
TALL SHRUBS								
Boxelder	10,983.2	0.8	1.2	10,866.4	1.6	--	--	113.2
Dogwood	9,481.2	--	--	5,695.2	296.0	--	3,490.0	--
Ash	11,104.0	1,092.0	20.0	6,454.8	488.0	--	2,638.4	410.8
Aspen	4,094.0	--	--	3,444.4	4.8	--	644.8	--
Cherry	18,109.2	2,366.4	369.6	2,745.2	1,551.2	--	11,076.8	--
Oak	146.4	--	146.4	--	--	--	--	--
Hazel	16,079.6	--	13,594.4	--	--	--	2,485.2	--
Juneberry	24,123.6	--	--	3,618.0	3,454.0	--	16,203.6	848.0
Willow	25,398.4	--	--	--	25,398.4	--	--	--
Elm	1,122.4	--	6.4	1,103.2	2.8	--	--	10.0
Total	120,642.0	3,459.2	14,138.0	33,927.2	31,196.8	--	36,538.8	1,382.0
LOW SHRUBS								
Juniper	584.7	584.7	--	--	--	--	--	--
Virginia creeper	220.7	--	--	57.7	163.0	--	--	--
Ribes	617.9	221.6	--	80.0	163.0	--	153.3	--
Rubus	20.3	--	19.4	--	--	--	0.9	--
Rosa	1,868.8	169.3	283.2	168.7	550.6	--	697.0	--
Vaccinum	9,188.8	340.1	140.3	5,123.8	2,069.1	--	1,192.4	323.1
Honeysuckle	33.1	--	--	33.1	--	--	--	--
Poison ivy	1,692.1	--	--	859.0	477.3	--	355.8	--
Grape	79.6	--	--	39.8	39.8	--	--	--
Total	14,306.0	1,315.7	442.9	6,362.1	3,462.8	--	2,399.4	323.1
All shrubs	134,948.0	4,774.9	14,580.9	40,289.3	34,659.6	--	38,938.2	1,705.1
State total	885,320.9	4,774.9	131,855.1	112,780.8	34,720.3	32,410.4	548,813.0	19,966.4

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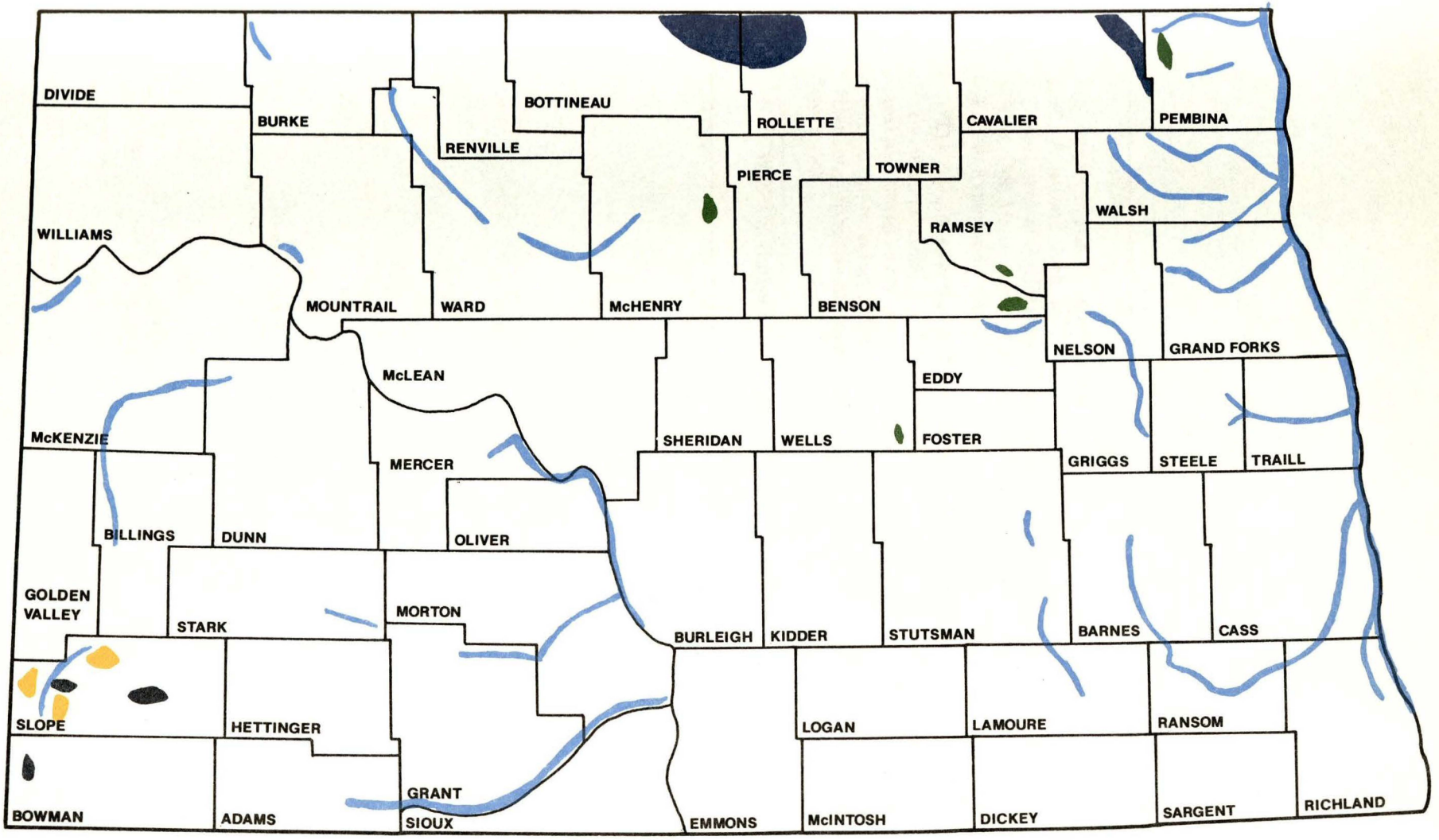
MAJOR FOREST TYPES
NORTH DAKOTA
1980



ASPEN

OAK

ELM-ASH-COTTONWOOD

PONDEROSA PINE

ROCKY MOUNTAIN JUNIPER

Jakes, Pamela J., and W. Brad Smith.
1982. A second look at North Dakota's timber lands, 1980. U.S. Department of Agriculture Forest Service, Resource Bulletin NC-58, 86 p. U.S. Department of Agriculture Forest Service, North Central Forest Experiment Station, St. Paul, Minnesota.

The second inventory of North Dakota forest resources shows a decline in commercial forest area between 1954 and 1980. Presented are text and statistics on forest area and timber volume, growth, mortality, ownership, stocking, future timber supply, timber use, forest management opportunities, and nontimber forest resources. A forest type map is included.

KEY WORDS: timber volume, growth, utilization, forest areas.